ISSN 2355-0082

# Analysis and Design of QR Code Based Information System on Plant Identification

## Case Study : Environmental Service Dormitory RW 04 Tegal Alur Sub-District, Kalideres District, West Jakarta

Ahmad Syaikhu[1], Rizky M. L. Soeryaprawira[2], Yoga A. Daswara[3], Cornelius M. Sarungu[4]
Information Systems Department, BINUS Online Learning, Bina Nusantara University, West Jakarta, Indonesia
[1]ahmad.syaikhu@binus.ac.id
[2]rizky.soeryaprawira@binus.ac.id
[3]yoga.daswara@binus.ac.id
[4]cornelius.sarungu@binus.ac.id

Accepted 29 April 2022
Approved 08 August 2022

***Abstract*— At the location of the environmental service dormitory in RW 04 Tegal Alur sub-district, Kalideres district, West Jakarta, the community cultivate various types of plants and there is a requirement to introduce or educate the public about types of plants and their benefits. The purpose of this research project is to analyze the needs, as well as to design the QR Code-based information system, especially in the process of educating the types of plants and their benefits in the area. The design process uses the object-oriented analysis and design (OOAD) method which explores UML modelling (use case, activity diagram, sequence diagram, class diagram). The analysis will be carried out on to be implemented business processes, then the results of the analysis are poured into the design of a QR code-based information system in the form of web and mobile app that can assist educational activities. Web application will be used by the administrator to manage data to be displayed in mobile app. Mobile app will be used by the user to explore plant species and their benefits based on QR code that installed near the plants.**

***Index Terms*—information system; qr code; object oriented analysis and design;**

## I. INTRODUCTION

QR code is already used in many aspects of our live. Ranging from digital payment, transportation ticketing, logistics, products and documents identification etc. More or less, it has become part of our daily activities.

In RW 04 of Tegal Alur sub-district, Kalideres district, West Jakarta, the place of a local environmental service dormitory, the local community cultivate various medicinal and other types of plants [1]. Because of the variety of the plants are quite a lot and they want to record and store the information with expectation that every community member or even other people from outside of the community can access and gain knowledge from it. This need spawned up an idea to create a mobile-based application that can reveal the name of the plants by scanning the QR code on the plant with user smartphone, and also can provide additional useful information. The mobile app is expected to help people on knowing the name and the benefits of the plants and also create awareness of the importance of the plants to their environment.

In this project we are utilizing Quick Response code (QR code) technology as a tool to identify plants in the environment, it is hoped that detailed information about plants planted by local residents can be converted into a two-dimensional code that is printed into a more concise and easy media.

According to John W. Satzinger, Robert B. Jackson, Stephen D. Burd., system design is a set of activities that describe in detail how the system will run. It aims to produce software products according to user needs [2]. Producing software includes the activity of analysis and design.

QR code is invented in 1994 and used by a Japanese automotive company Denso Wave. It is come under category of 2D barcode. There are some variants of 2D barcodes, and it got popularized since early 2000. A decade later QR code emerge as the dominant one on the field, especially when it started to be used in digital payment. QR code have some significant advantages such as can contain large amount of information, consume less space, highly resistance to damage and

distortion, readable from any directions, scalable on size, have standardized process [3].

The exploitation of QR code to identify simplify the process of identification of things is already conducted since the emergence of the QR code itself. It already explored to sign and validate certificate of education back in 2011 [4]. In library service, QR code has been explored to store the information of a book complete with its code and location. It speeded up the process of searching or placement in its related rack in the library [5]. Even further, the QR code can also be used for digital library, where the users can scan the QR code of a book of their interest after searching via internal search engine, and then brought them to the download page from their mobile phone [6]. Another use of QR code in this field is seminar registration, student presence identification and recording and education tools registration and information distribution. On seminar registration its features consist of QR code generation, placement and presence recording of the seminar participants [7]. QR code can also be put on education tools of preliminary to high school, either for asset management or information distribution purpose [8]. Presence system is an integral part of the education system, the use of QR code level it up. It can be implemented on either onsite or online classes [9].

In business field, the QR code also has been used to support the daily business process. Employee presence system based on QR code already been used in business to replace the paper based traditional presence system [10]. Asset management system could also use the QR code on registering the assets and track their movement [11]. Another example is on mail administration process, where the QR code is used to replace signature. It increased the security aspect of the digital formal mail delivery between institution or inside the organization [12]. The application in digital payment maybe is the most popular. Even in a small-scale environment like a university, the students that are surveyed mostly ready and eager to use the digital payment using QR code and mobile app [13].

In this project, we try to implement the QR code to help people doing the identification of plants that grow around them, and extract any information about the particular plant, such as its benefits and how to maintain it. Previous research has been conducted in Jompie botanical garden to implement the use of QR code for plant identification and information distribution [14]. The differences with our project are in the exploitation of the cloud platform and printing process of the QR code.

The reasons we choose mobile app to be used in our project are the access to the native functionality such as camera to scan the QR code, and the offline data access support where we could design a local data cache mechanism that allow the user keep using the functionality of the app while offline, and it is relatively faster than web app [17].

## II. METHOD

In this project we used simple methodology as presented in Fig. 1. The first step is conducting data gathering. After most required data are captured and recorded, we use it on analysis of the existing system, and it will lead us to the problem identification stage. After the problems are defined, we then jump into the solution design activity that will resulted in new system design.

The methodology used in this project (Fig. 1) is actually is a section of the waterfall method of software development lifecycle. It is not fully adopted because of the scope is only to design phase. The scope of this project is to analysis and design, so we only cover the analysis process, result and design elements based on the object-oriented analysis and design method.

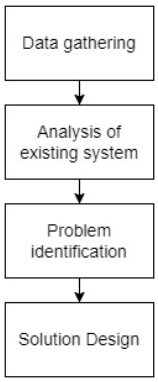



Fig. 1. Methodology used in this project.

The data gathering, analysis of existing system and problem identification are part of the analysis phase, while the design phase is in the solution design.

On the data gathering we conduct the interview and observation of recent process. The results then used to create the process map of existing system, while the copy of documents and any other artifact will be used in designing the database and forms. After the process map is built, analysis is done based on it. Process review together with the environment service team is done to map all problems that already spotted, identify problems that probably still hidden and to get deeper understanding about the whole process. Once all problems are identified, risks related to each problem are determined. Next step is to map the solutions or features for each identified problem. Solution design then conducted to design each feature using object-oriented design method supported with UML diagrams.

## III. RESULT AND DISCUSSION

### A. *Data Gathering*

In carrying out the analysis and design of a QR code-based system, several methods are used to collect data, namely as follows:

1. The method of analysis consists of:

a. Conduct observations and field studies directly at the dormitory of the environmental service office in the form of interviews with the local people about what they need from an information system to help them find out the names and benefits of each plant that they cultivate and grow around their area.

b. Analysis of observation findings and field studies: Analyze the results of observations and field studies data that have been obtained to find weaknesses and problems in the current system

c. Identification of information requirements: Identifying the system requirements needed for system design for information exposure of cultivated plants.

d. Identification of system requirements: Identify the system requirements required for the design of the expected system.

2. Literature study is also conducted, and it consists of reading and studying literature, books, essays and journal papers that highly related to existing problems.

*B. Analysis of Existing System*

Current system of plants information management is done by the environmental service team and it was done manually. We could observe from flowchart in Fig. 2 that depicts how current system works.

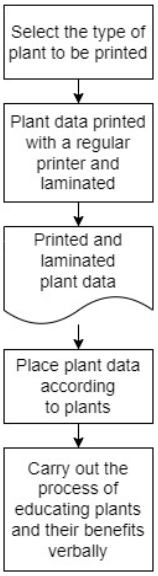



Fig. 2. Process flow of existing system.

e. The team identified as many plants as they can around their environment and record them manually in a record book. Then they select which plant will be marked with name and other information. The name and information to be displayed are printed in a plain paper and laminated, coated with transparent plastic surface (Fig. 3). The lamination is meant to make the stuf weatherproof, but in fact it cannot last long, the endurance just get shorter on rainy season


Fig. 3. Photos of the paper-based information on the plant.

The laminated paper then placed close to the related plant. After most of the plants are marked, the management of environmental service team then launch an education program to the local community. They educate the community about the benefits and the use of each plants. The expectation of this program is that the awareness about useful plants in the community will increase gradually and they can easily utilize those plants when needed. The education still be done verbally with one trainer guide a group of local people and doing a short trip touring around the area. Along the trip the trainer explained the information of each plants to the group.

*C. Problem Identification*

From the current system flow and the interview results we could identify some problems in it. We used Ishikawa "fishbone" diagram to map all the problems and its categories (Fig.4).

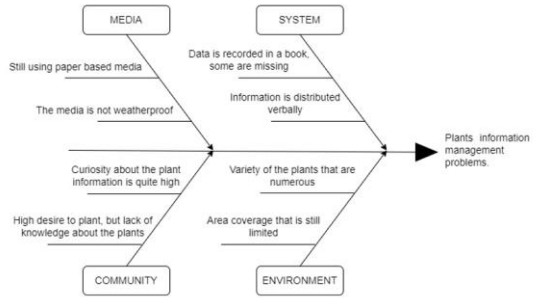



Fig. 4. The Fishbone diagram of the problems.

The identified problems are presented in table below (Table I) along with the risks.

TABLE I. Identified Problems.

| No. | Problem | Risk |
|---|---|---|
| 1 | Plants data management that still being done manually. Plants data still recorded in a book (paper-based media). | Activities done on the data management are not well recorded. Plants data could be gone or erased if something happen with the book. |
| 2 | Plants data is printed in a plain paper, and laminated. It's not a weatherproof. | Plants data is susceptible to erased by the rough weather. |
| 3 | The community education process is done verbally. | Repeating the same work every time a new group come. |
| 4 | There are still many people around the area that do not know about the plants, its benefits and how to utilize it. | The plants will be left ignored and unused, regardless of the potentials and high benefits. |
| 5 | High desire to plant but lack of knowledge about the plants. | The people probably will plant any of the vegetation they like without ever knowing the purpose and benefit. |
| 6 | The information is distributed verbally. | The information become difficult to remember and accessed. |
| 7 | Variety of the plants that are numerous. | Without a storage media and information system, it would be difficult to manage the data. |
| 8 | Area coverage that is still limited. | More man power or work hours is needed to enlarge the coverage area if still using the manual method. |

### *D. Solution Design*

Based on the problems faced by the environmental service dormitory team, we define a solution equipped with features related with the problem list on Table 1. After discussing with the environment service team and some local informal leaders, we agree on deciding to build an information system to help the team eliminate those problems. The agreed solution to be implemented is a mobile app with web administration and services module as the backend. The features to be put in those app are listed below (Table II).

TABLE II. Solution list.

| No. | Problems | Solution / Features |
|---|---|---|
| 1 | Plants data management that still being done manually. Plants data still recorded in a book (paper-based media). | Web application for administration purpose. |
| 2 | Plants data is printed in a plain paper, and laminated. It's not a weatherproof. | Replacing the plain paper with synthetic yupo, and use the Zebra GT800 printer with full resin ribbon to create a weatherproof label for the QR code. |
| 3 | The community education process is done verbally. | Mobile app to access the information. Any people can install the app from playstore, register and use it immediately. |
| 4 | There are still many people around the area that do not know about the plants, its benefits and how to utilize it. | Same as number 3.<br>Enrich the data of plants in the area.<br>There should be a feature to show all the necessary information about the plant, including its name, type, category, latin name, description, benefit, how to plant, grow and maintain, etc. |
| 5 | High desire to plant but lack of knowledge about the plants. | Same as number 4. |
| 6 | The information is distributed verbally. | Same as number 4. |
| 7 | Variety of the plants that are numerous. | Database connected to the web application to store all data.<br>QR generation for each plant. |
| 8 | Area coverage that is still limited. | Same as number 4.<br>Still need to go around the area to put the new labels. |

The flowchart of system requirements in the environmental service dormitory area can be seen through the flowchart below (Fig.5 and 6).

We design the new process with two separate roles, the administrator and the user. The administrator is person who manage the configuration, information and also the QR code from generating, printing to onsite installation. The process flow is shown in Fig. 5. The other role is the user, person who register, login into the app, scan the QR code and get the information of the plant. The process flow is shown in Fig. 6.

From system architecture perspective, to accommodate those two separate roles we have to connect the mobile app, that function as the frontend, to the web application that serve as the backend. The architecture diagram is shown in Fig. 7.

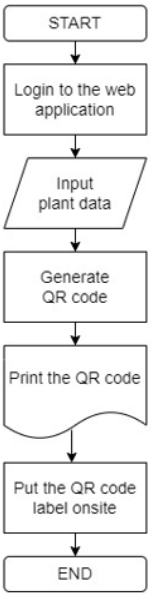



Fig. 5. Process flow of the administrator role

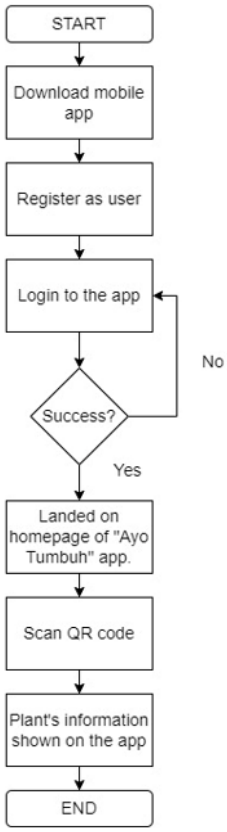



Fig. 6. Process flow of the user role.

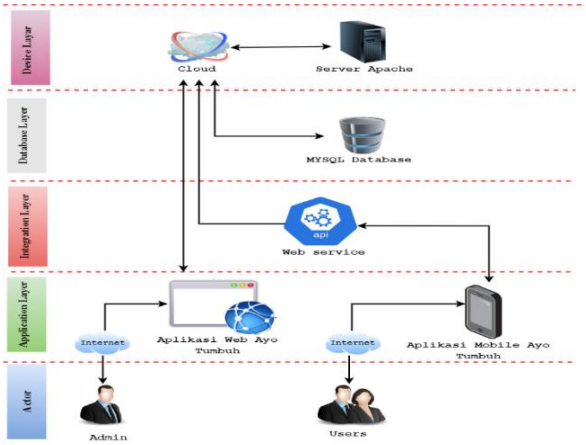



Fig. 7. The architecture diagram of the system.

In our proposed architecture, application server, database server and web service server are hosted in the google cloud platform. After all of those servers are activated, all the services listed in web service registry can be accessed by the mobile app and web client. Known previous research is using proprietary server architecture on its implementation [14]. Apache server is used to host the PHP based web application. Apache is well known for its easy configuration and secure socket layer (SSL) support [16]. The protocol used is secure http (https) for security reason, because this will be used as public service application.

After defining the process flows and the system architecture, we continue into the other design elements of this QR code-based plant information system consists of use case diagrams, detailed use case scenario or description, activity diagrams, sequence diagrams, class diagrams, web user interfaces, mobile user interfaces and system specifications.

The next step for designing a QR code-based system is making use case diagrams for web application and mobile app as follows:

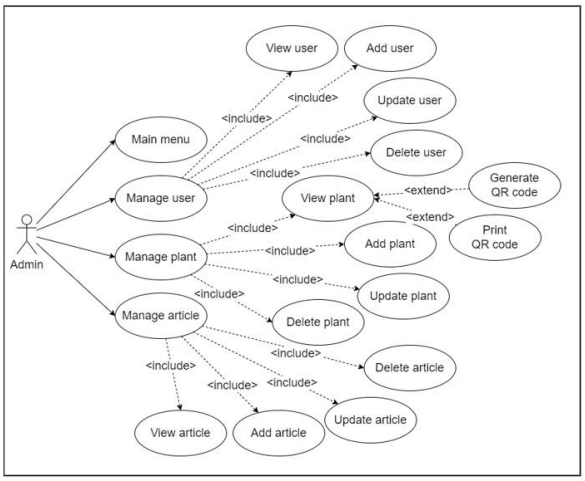



Fig. 8. Web application use case diagram.

The administrator can login to the web application and taken into the homepage. On the main menu, the administrator can choose to manage user data, manage plant data and manage articles. Each of the data management use case includes view, add new, edit and delete actions (Fig. 8).

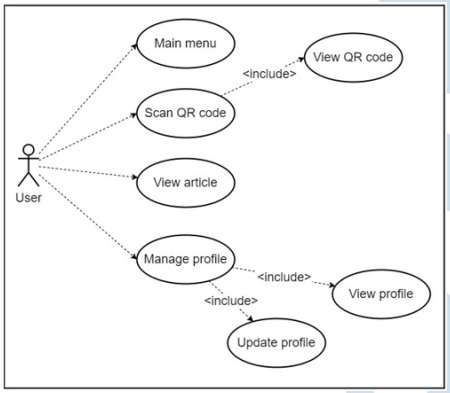



Fig. 9. Mobile app use case diagram.

The user can login into the mobile app and taken into the main menu. The user then can scan QR code, view articles and manage their profile (Fig. 9).

The next step is to create a detailed use case scenario of each use case diagram above. The following are nine examples of the use case scenario, seven are use cases of the web application and two use cases are from the mobile app design (Table III-XI):

TABLE III. Use case scenario of the main menu of the web application.

| | |
|---|---|
| **Use Case Name:** | Main menu |
| **Scenario:** | Actor want to visit the homepage of the web. |
| **Triggering Event:** | Actor is Login. |
| **Brief Description:** | Actor need to visit the homepage of the web. |
| **Actors:** | Administrator |
| **Related Use Case:** | - |
| **Stakeholders:** | Administrator |
| **Preconditions:** | Actor already register and login. |
| **Post Conditions:** | After actor registered and login, the system will take the actor to the web homepage. |
| **Flow of activities** | **Actor** / **System** |
| | 1. Actor choose Register option.<br>2. Actor input the data.<br>3. Click Register button. / 1.1 Display the registration form.<br>2.1 –<br>3.1 Validate the registration form. |
| | 4. Actor choose Login option.<br>5. Actor input username and password.<br>6. Actor click Login. / 4.1 Display the login form.<br>5.1 -<br>6.1 Validate the input data.<br>6.2 If input data valid, display the web homepage.<br>6.3 If input data invalid, show error message and back to the Login page. |
| **Exception Conditions:** | 2.1 Invalid email/username.<br>2.2 Invalid password. |

TABLE IV. Use case scenario of manage plant data, part of the web application.

| | |
|---|---|
| **Use Case Name:** | Manage plant data |
| **Scenario:** | Actor need to manage the plants data. |
| **Triggering Event:** | Actor choose the Manage Plants Data menu option. |
| **Brief Description:** | Actor need to see the plants list and manage the plants data. |
| **Actors:** | Administrator |
| **Related Use Case:** | Main menu<br>Show plant data<br>Add plant data<br>Edit plant data<br>Delete plant data |
| **Stakeholders:** | Administrator |
| **Preconditions:** | Actor already login and choose Manage Plants Data menu option. |
| **Post Conditions:** | System will display the Manage Plant Data page and the list of plants. |
| **Flow of activities** | **Actor** / **System** |
| | 1. Actor click the Manage Plant Data option. / 1.1 Display plants list. |
| **Exception Conditions:** | 1.1 Database down |

TABLE V. Use case scenario of the user data management of the web application.

| | |
|---|---|
| **Use Case Name:** | Manage user data |
| **Scenario:** | Actor need to manage user data that already register from mobile app. |
| **Triggering Event:** | Actor choose the Manage User Data option. |
| **Brief Description:** | Actor need to see the list of users and manage the user data. |
| **Actors:** | Administrator |
| **Related Use Case:** | Main menu<br>Show user data<br>Add user data<br>Edit user data |

| | | |
|---|---|---|
| | Delete user data | |
| **Stakeholders:** | Administrator | |
| **Preconditions:** | Actor already login and choose Manager User Data options. | |
| **Post Conditions:** | After click Manage User Data, system will display the registered users list. | |
| **Flow of activities** | **Actor** | **System** |
| | 1. Actor click Manage User Data menu option. | 1.1. Display all the registered users list. |
| **Exception Conditions:** | 1.1 Database down | |

TABLE VI. Use case scenario of article management, part of the web application.

| | | |
|---|---|---|
| **Use Case Name:** | Manage article | |
| **Scenario:** | Actor need to view articles. | |
| **Triggering Event:** | Actor choose Manage Article option. | |
| **Brief Description:** | Actor need to view and manage articles in the Manage Article menu option. | |
| **Actors:** | Administrator | |
| **Related Use Case:** | Main menu<br>Show article<br>Add article<br>Edit article<br>Delete article | |
| **Stakeholders:** | Administrator | |
| **Preconditions:** | Actor already login and choose Manage Article menu option. | |
| **Post Conditions:** | System will display the Manage Article page and the list of articles. | |
| **Flow of activities** | **Actor** | **System** |
| | 1. Actor click Manage Article menu option. | 1.1. Display list of articles. |
| **Exception Conditions:** | 1.1 Database down | |

TABLE VII. Use case scenario of data presentation, part of the web application.

| | | |
|---|---|---|
| **Use Case Name:** | Show plant data | |
| **Scenario:** | Actor need to view plant data. | |
| **Triggering Event:** | Actor choose one of the plant data from the list of plants. | |
| **Brief Description:** | Actor need to view a plant data in detail. | |
| **Actors:** | Administrator | |
| **Related Use Case:** | Manage plant data<br>Generate QR code<br>Print QR code | |
| **Stakeholders:** | Administrator | |
| **Preconditions:** | Actor already login and click one of the plants in the list of plants. | |
| **Post Conditions:** | System shows the detail data of the selected plant. | |
| | **Actor** | **System** |
| **Flow of activities** | 1. Actor select one plant from the list. | 1. Display detail data of the selected plant. |
| **Exception Conditions:** | 1. Database down | |

TABLE VIII. Use case scenario of generate QR code, part of the web application.

| | | |
|---|---|---|
| **Use Case Name:** | Generate QR code | |
| **Scenario:** | Actor need to generate QR code of a plant. | |
| **Triggering Event:** | Actor choose a plant and click Generate QR code option. | |
| **Brief Description:** | Actor generate QR code of a plant. | |
| **Actors:** | Administrator | |
| **Related Use Case:** | Show plant data | |
| **Stakeholders:** | Administrator | |
| **Preconditions:** | Actor already login.<br>Actor already clicked the Manage Plant Data menu option.<br>Actor click generate QR code. | |
| **Post Conditions:** | QR code generated and stored in the database. | |
| **Flow of activities** | **Actor** | **System** |
| | 1. Actor click Generate QR code in the table row. | 1.1 Generate QR code of the selected plant.<br>1.2 If the QR can be generated, system shows a success notification along with the picture of the QR. QR data is saved in the database.<br>1.3 If the QR failed to generate, system shows an error notification. Will go back to the Manage Plant Data page when the user clicked the OK button. |
| **Exception Conditions:** | 1.1 Database down | |

TABLE IX. Use case scenario of print QR code, part of the web application.

| | |
|---|---|
| **Use Case Name:** | Print QR code |
| **Scenario:** | Actor wants to print the QR code of the selected plant. |
| **Triggering Event:** | Actor click the Print QR on the selected plant data. |
| **Brief Description:** | Actor prints the QR code of a selected plant. |
| **Actors:** | Administrator |
| **Related Use Case:** | Show plant data |
| **Stakeholders:** | Administrator |
| **Preconditions:** | Actor already login and click one of the plants in the list of plants. |

| | | |
|---|---|---|
| **Post Conditions:** | QR code of the selected plant is printed. | |
| **Flow of activities** | **Actor** | **System** |
| | 1. Actor click the QR code of a plant in table row.<br>2. Actor click the Print QR code option. | 1. Display the QR code in a pop-up window.<br>2. Print QR Code in selected media. |
| Exception Conditions: | 1.1 Database down<br>2.1 Disconnected from local network<br>3.1 Printer cannot be accessed | |

The following tables are use case scenario examples from the mobile app module (Table X-XI):

TABLE X. Use case description of main menu in mobile app.

| | | |
|---|---|---|
| **Use Case Name:** | Main menu | |
| **Scenario:** | The Actor want to visit the main menu in mobile app. | |
| **Triggering Event:** | The actor is doing login. | |
| **Brief Description:** | The actor is visiting the main menu in mobile app. | |
| **Actors:** | User | |
| **Related Use Case:** | Show plant data<br>Show user data | |
| **Stakeholders:** | User | |
| **Preconditions:** | The actor is already registered as user and doing login. | |
| **Post Conditions:** | The homepage is displayed and the actor can access the main menu options. | |
| **Flow of activities** | **Actor** | **System** |
| | 1. Actor choose Register.<br>2. Actor input data in Full Name, Email, Password and Confirm Password fields.<br>3. Actor click "Register" button. | 1.1 Display the registration form.<br>2.1 –<br>3.1 System will store the data input by the actor. |
| | 4. Actor choose Login.<br>5. Actor fill the username and password.<br>6. Actor click the login button. | 4.1 System displaying the login form.<br>5.1 –<br>6.1 Validate the input data.<br>6.2 If input data valid then system will display the main menu.<br>6.3 If the input data is invalid then the system display an error message and asking the user to input again the proper username/ password. |
| **Exception Conditions:** | 1.1 Smartphone is not connected to the internet.<br>3.1 Duplicated data.<br>4.1 Smartphone is not connected to the internet.<br>6.1 Invalid username/password. | |

TABLE XI. Use case description of scan QR code, part of the mobile app.

| | | |
|---|---|---|
| **Use Case Name:** | Scan QR code | |
| **Scenario:** | The actor wants to scan the QR code from the mobile app. | |
| **Triggering Event:** | The actor click scan QR code. | |
| **Brief Description:** | The actor can access the mobile phone camera to scan the QR code. | |
| **Actors:** | User | |
| **Related Use Case:** | Login, Show plant data | |
| **Stakeholders:** | User | |
| **Preconditions:** | The actor is already login and choose the scan QR code. | |
| **Post Conditions:** | QR code scanned and the plants data is shown. | |
| **Flow of activities** | **Actor** | **System** |
| | 1. Actor click scan QR Code<br>2. Actor direct the camera to the plants QR code. | 1.1 System will display the mobile phone camera.<br>2.1 QR code data validation.<br>2.2 If the QR code data is valid then system will display the plant data.<br>2.3 If the QR code data is invalid then the system will pop up an error message and going back to the mobile camera display to recapture the QR code. |
| **Exception Conditions:** | 1.1 The camera is broken or error.<br>2.1 Invalid QR code data. | |

Next step we build the activity diagram for each use case that describe the process flow of each use case. The following are examples of activity diagram from the system (Fig. 10-12):

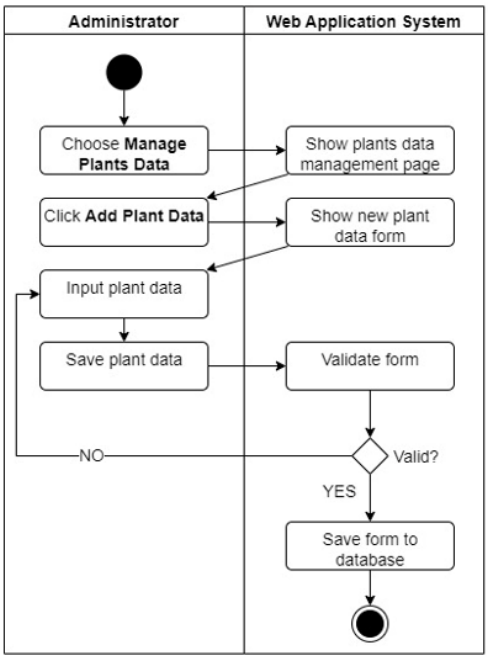



Fig. 10. Activity diagram of Add Plant Data.

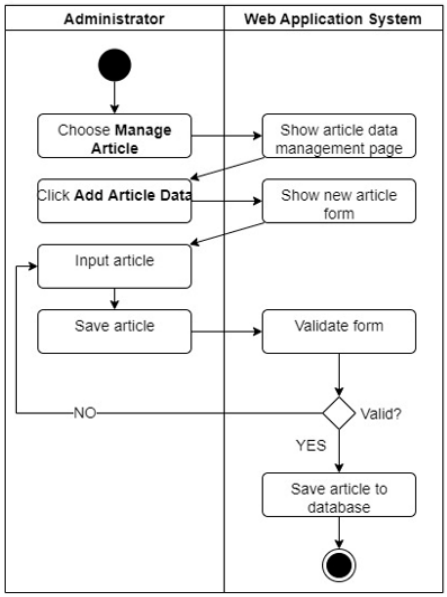



Fig. 11. Activity diagram of Add Article Data.

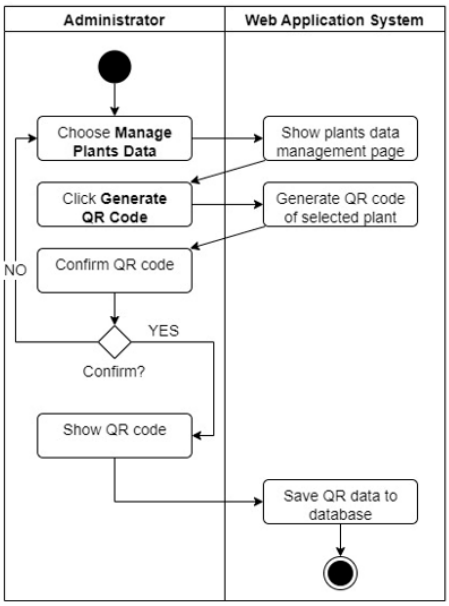



Fig. 12. Activity diagram of Generate QR Code.

After the activity diagrams are finished and reviewed, we then build the sequence diagram of each use case. The following are the sequence diagram examples of the system (Fig. 13-16):

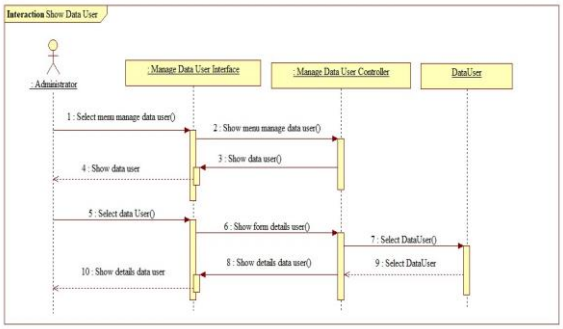



Fig. 13. Sequence diagram of main menu.

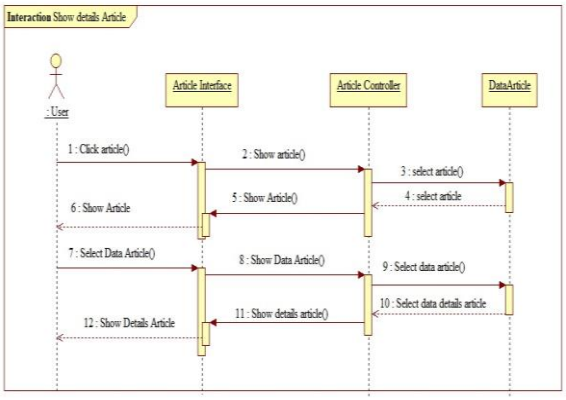



Fig. 14. Sequence diagram of view article detail.

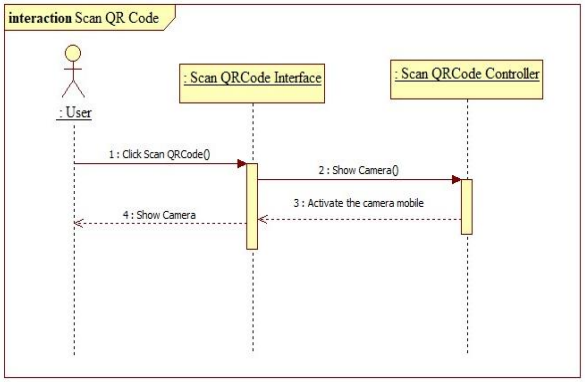



Fig. 15. Sequence diagram of scan QR code.

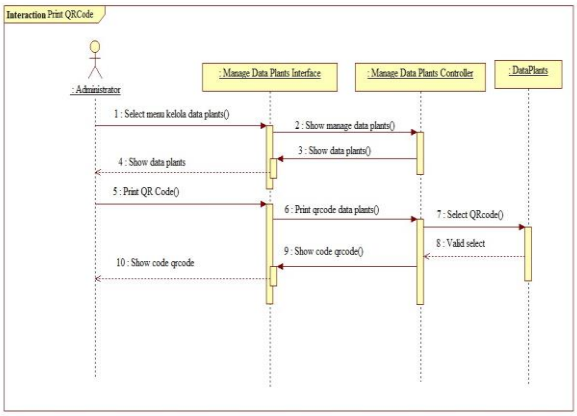



Fig. 16. Sequence diagram of Print QR code.

After finishing and reviewing the sequence diagrams, we continue to the next step which is building the class diagram of the system. The following is the class diagram design (Fig. 17):

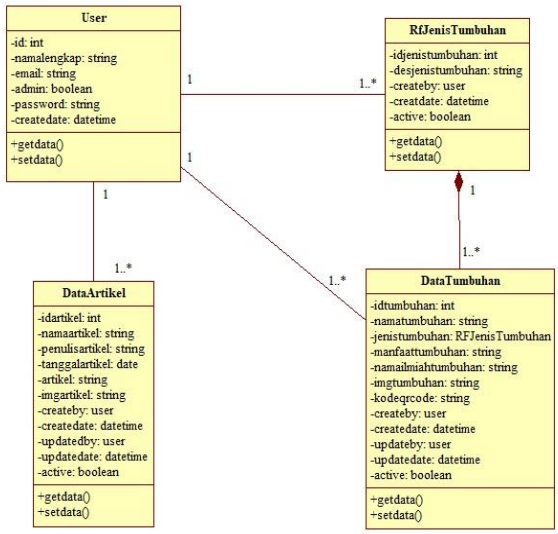



Fig. 17. Domain class diagram of the system.

Next step we define the data dictionary that consists of data items that will be saved into the database. We provide tables below for the data dictionary (Table XII-XV)

TABLE XII. User data.

| Field | Type | Null | Default |
|---|---|---|---|
| id | int(6) | No | *Primary Key* |
| namalengkap | varchar(50) | Yes | |
| email | varchar(50) | Yes | |
| admin | bit(1) | Yes | |
| password | varchar(50) | Yes | |
| createdate | datetime(8) | Yes | |

TABLE XIII. Plant data.

| Field | Type | Null | Default |
|---|---|---|---|
| idtumbuhan | int(4) | No | *Primary Key* |
| namatumbuhan | varchar(100) | Yes | |
| jenistumbuhan | int(4) | Yes | |
| manfaattumbuhan | varchar(500) | Yes | |
| namailmiahtumbuhan | varchar(100) | Yes | |
| imgtumbuhan | varchar(200) | Yes | |
| kodeqrcode | varchar(50) | Yes | |
| createby | int(4) | Yes | |
| createdate | datetime(8) | Yes | |
| updateby | int(4) | Yes | |
| updatedate | datetime(8) | Yes | |
| active | bit(1) | Yes | |

TABLE XIV. Plant category data.

| Field | Type | Null | Default |
|---|---|---|---|
| idjenistumbuhan | int(4) | No | *Primary Key* |
| desjenistumbuhan | varchar(50) | Yes | |
| createby | int(4) | Yes | |
| creatdate | datetime(8) | Yes | |
| active | bit(1) | Yes | |

TABLE XV. Article data.

| Field | Type | Null | Default |
|---|---|---|---|
| idartikel | int(4) | No | *Primary Key* |
| namaartikel | varchar(100) | Yes | |
| penulisartikel | varchar(50) | Yes | |
| tanggalartikel | date(3) | Yes | |
| artikel | varchar(500) | Yes | |
| imgartikel | varchar(200) | Yes | |
| createby | int(4) | Yes | |
| createdate | datetime(8) | Yes | |
| updateby | int(4) | Yes | |
| updatedate | datetime(8) | Yes | |
| active | bit(1) | Yes | |

After done with the structural design of the system which represented by the class diagram and data dictionary, we continue the design process to the mock up or user interface design.

In web application homepage (Fig. 18), there are three menu options that can be selected, they are : Manage plant (kelola tumbuhan), Manage users (kelola user) and manage article (kelola artikel).

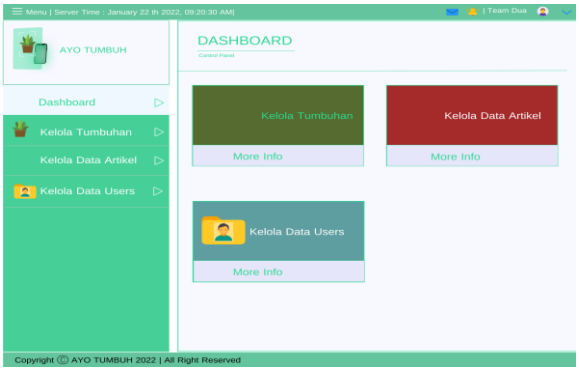



Fig. 18. Web application homepage.

In plant management page (Fig. 19), there is a table containing list of plants that have been stored in the database. We could see most important information about the plant (plant name, category, benefit of the plant, latin name, image, QR code, audit logs and action icons).

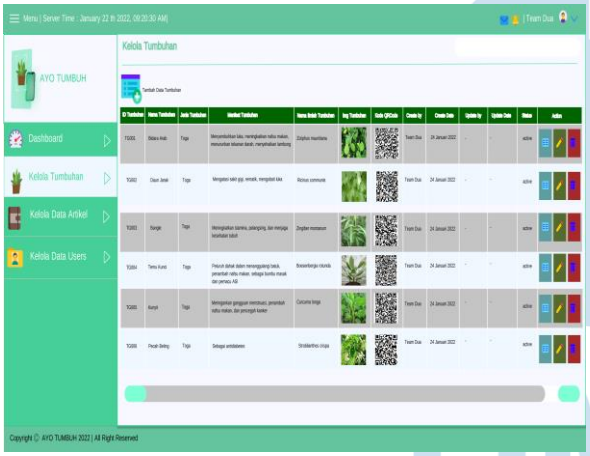



Fig. 19. Plant management page.

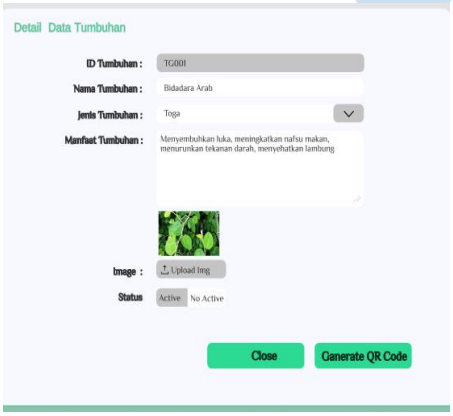



Fig. 20. Plant data detail page.

When we select one of the rows in the table and click the plant picture or edit icon, the system will display a pop-up form containing the complete information about the plant (Fig. 20). The administrator could upload the plant image, set plant data status (active/inactive) and generate the QR code. After the administrator generate the QR code, the system will display the result along with close, print and save buttons. Printing is allowed in this stage (Fig. 21). The size of the QR code should be big enough to get the public attention and trigger the desire to scan it [15].


Fig. 21. Print QR code UI.

In manage articles menu, the administrator can add new article, view, edit and delete existing articles (Fig. 22). The display is the same with user management and plant management menu, there is a list of items and the administrator can select one item to do related actions on it.

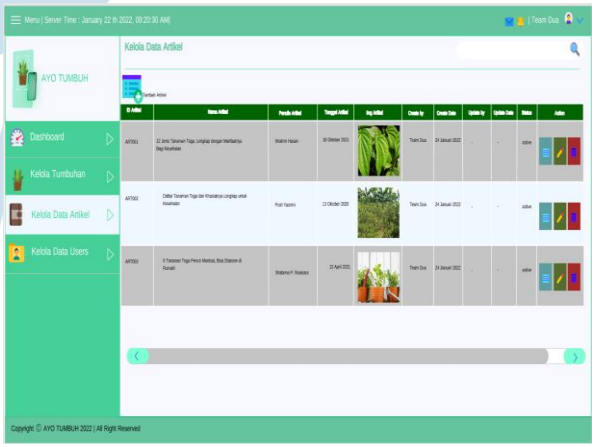



Fig. 22. Article management page.

When the administrator wants to add new article, they can click the add article icon in the top left corner above the table. System will display an article form to be filled, then can be saved or cancelled (Fig. 23).

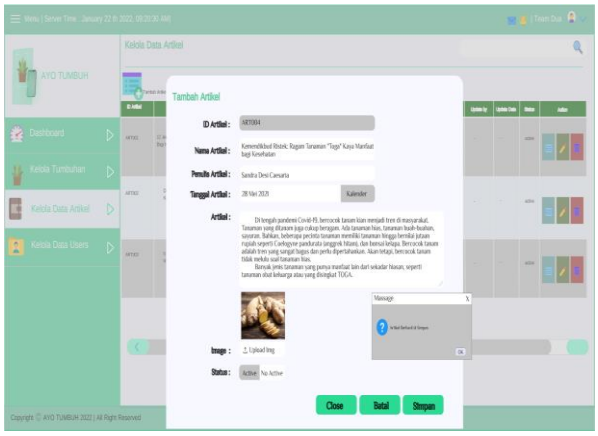
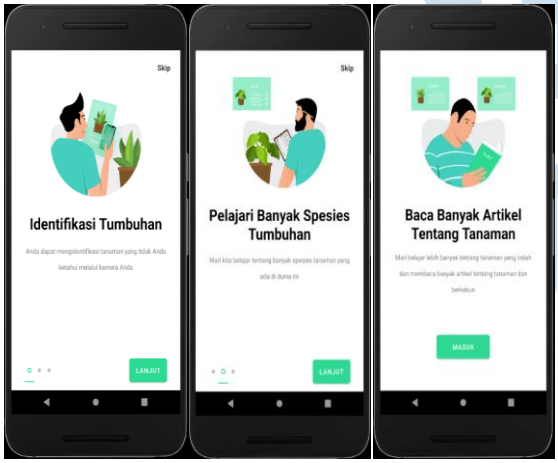


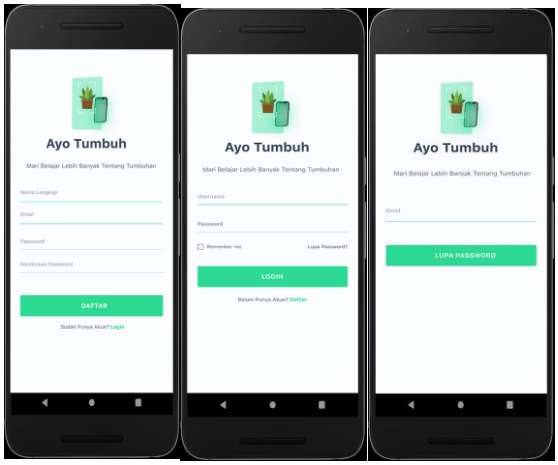

Fig. 23. Add new article page.

On the user side, after the app is installed in the mobile phone, the user opened the app and brought to the welcome page that shows some information (Fig. 24.a-c). The user then can register (Fig. 25.a), login (Fig. 25.b) and also click forgot password if they forget their password (Fig. 25.c). After successful login, they will be brought to the homepage (Fig. 26.a). In the area of service, around the environmental service dormitory, the user can scan any QR code that already been installed on any plants they found along the way and related plant information will be displayed immediately (Fig. 26.b-c).



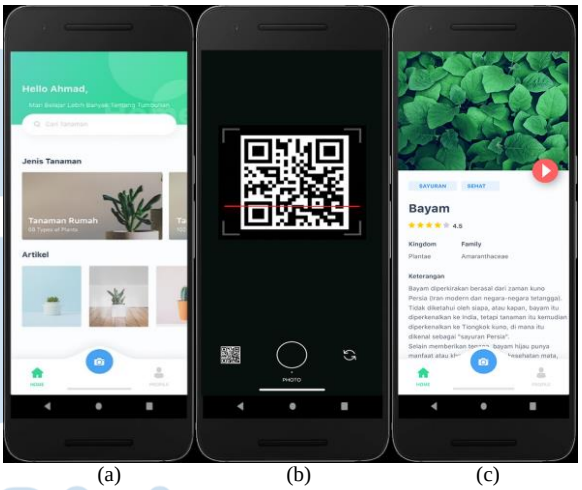

(a) (b) (c)

Fig. 24. Front page of the mobile app.




(a) (b) (c)

Fig. 25. The register, login and forgot password pages of the mobile app.




(a) (b) (c)

Fig. 26. The mobile app UIs (Homepage, Scan QR and Display Information).

Given below are the specifications for hardware and software to operate the system:

TABLE XVI. Web system specification.

| | Hardware | Software |
|---|---|---|
| Cloud Server | 1. Processor: Intel Xeon E3-1270 v6 4 Cores, 3.80 GHz | 1. Windows Server |
| | 2. Memory: 16 GB RAM | 2. MYSQL |
| | 3. Storage: 1 x 1 TB HDD | 3. NET Framework 4.5 |
| | 4. bandwidth: 20 TB bandwidth | |

TABLE XVII. Mobile app specification.

| | Hardware | Software |
|---|---|---|
| HP Android | 1. Processor: Dual-core 1 GHz Cortex-A9 | 1. Jelly Bean (4.2.2) – Red *Velvet* (*Android 11*)<br>2. iOS 10 – iOS 15 |
| | 3. Memory: Internal 4 GB, 512 MB RAM | 2. Android Studio dan iOS |
| | 4. Display: Capacitive touchscreen, 480x800 pixels, 4.0 Inches | |

| | | |
|---|---|---|
| | 5. Camera 5 MP, 2592 x 1944 pixels | |

## IV. CONCLUSION

The results obtained from the analysis and design during the implementation of this project are as follows:

1. With the design of a QR code-based information system on plants, can help the dormitory of the environmental service RW04 sub-district Tegal Alur, district Kalideres, West Jakarta to increase and widened their services to the pulic of the area.
2. The implementation of QR code scanning on plant identification and information extraction increase the efficiency of information distribution to the public.
3. The use of mobile app expanded the coverage area of services, but it should be followed by plant identification actions that include the placement of the QR code on the plants.
4. The change on the QR code printing media increase durability and the resistance against the weather.
5. Data on plant species obtained during the research at the dormitory of the environmental service office RW04 sub-district Tegal Alur, district Kalideres, West Jakarta, only a few RTs namely RT02, RT04 and RT05 out of a total of 8 RTs that can provide information related to plant species, so the data obtained can still be optimized and completed in the future for educational facilities about the plants they grew.
6. This model still has a risk of loosing the label because of stealing attempt.
7. Further research project could be initiated by exploring the use of artificial intelligence (AI) to detect the plant, or at least detecting the leave pattern. It will remove the need of using QR or barcode.

## ACKNOWLEDGMENT

We would like to give thanks to all of these parties that always supported the research team and involved in our project:

- Dinas Lingkungan Hidup, Tegal Alur, West Jakarta.
- Bina Nusantara University, Jakarta

## REFERENCES

[1] Kesatu.co. “RW 04 asrama DLH Tegal Alur, kampung asri di tengah kota Jakarta,” (Online). Accessed: 12-17-2021. Available: https://kesatu.co/rw-04-asrama-dlh-tegal-alur-kampung-asri-di-tengah-kota-jakarta/.

[2] John W. Satzinger, Robert B. Jackson, Stephen D. Burd. “System analysis and design in a changing world,” (7th edition). Boston: Cengage Learning. 2016.

[3] M. Querini, A. Grillo, A. Lentini, G.F. Italiano. "2D color barcodes for mobile phones," International journal of computer science and applications, 8(1), 136-155. 2011.

[4] Anita Rahmawati, Arif Rahman. "Sistem pengamanan keaslian ijasah menggunakan qr-code dan algoritma base64," Jurnal sistem informasi Indonesia, 1(2), 105-112. 2011.

[5] Rastri Prathivi. “Analisa sistem QR code untuk identifikasi buku perpustakaan,” Jurnal Pengembangan Rekayasa dan Teknologi, 14(2), 37-40. December, 2018.

[6] Muhammad Fabio Armadani, Dedi Mulyadi. "Digitalisasi manajemen sistem dokumen pengelolaan perpustakaan menggunakan qr code dan digital signature," Jurnal buana ilmu, 6(1), 13-19. 2021.

[7] Zen Munawar. "Aplikasi registrasi seminar berbasis web menggunakan qr code pada universitas xyz," Jurnal teknologi informasi dan komunikasi, 6(2), 128-150. 2019.

[8] Barra Purnama Pradja, Abdul Baist, Aan Subhan Pamungkas. “Pengembangan alat peraga matematika terintegrasi QR code sebagai sumber belajar bagi mahasiswa calon guru,” Jurnal Penelitian Pembelajaran Matematika, 14(1), 1-11. 2021.

[9] Darul Mukminin, Ameliana, Adiiba Dwikanthi, Lukas Umbu Zogara. "Aplikasi kehadiran siswa berbasis android menggunakan qr code pada bimbel excellent institute," Jurnal teknoinfo, 16(1), 66-71. 2022.

[10] Renaldi P. Tumanggor, Elvira Asril, Guntoro. ”Sistem informasi absensi karyawan menggunakan qr code (quick response) di pt. redes jaya perssada,” Jurnal JITaCS, 1(1), 20-29. 2021.

[11] Muhammad Luthfi Syam, Erdisna. "Sistem informasi stok barang menggunakan qr-code berbasis android," Jurnal informatika ekonomi bisnis, 4(1), 17-22. 2022.

[12] Wahyudi Agustiono, Intan Rofika Putri, Devie Rosa Anamisa. "Desain layanan e-surat untuk desa waru barat, pamekasan, madura menggunakan qr code," Jurnal teknologi informasi dan ilmu komputer (JTIIK), 8(6), 1127-1136. 2021.

[13] Santa Frita Saragih, Elmor Benedict Wagiu. “Analisa perencanaan pembayaran menggunakan sistem qrcode di industrial universitas advent indonesia,” Jurnal TeIKa, 9(1), 15-29. April, 2019.

[14] Muh. Ismail, Masnur, Al Ghazali Syam. “Aplikasi qr code sebagai sarana penyampaian informasi pohon dikebun raya jompie,” Jurnal sintaks logika -1(1), 33-41. January, 2021.

[15] Dedek Arianti, Mahyuzar. “Efektivitas penggunaan aplikasi QR code (studi sosialisasi oleh harian serambi indonesia dan pemahaman masyarakat kecamatan kuta alam banda aceh),” Jurnal Ilmiah Mahasiswa FISIP Unsyiah, 2(2), 79-94. May, 2017.

[16] Irmayani Syafitri. “Pengertian apache beserta fungsi, kelebihan dan kekurangan apache yang perlu anda ketahui,” (Online). Accessed: 19 March 2022 from https://www.nesabamedia.com/pengertian-apache/

[17] Naveen Kumar, “Mobile apps vs web apps - what's the difference?,” (Online). Accessed: 25 July 2022 from https://www.joomdev.com/mobile-apps-vs-web-apps/.