

MOBILE APPLICATION FOR HALAL FOOD PRODUCT INFORMATION WITH GEOFENCING TECHNOLOGY BASED ON QR CODE

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Abstract

Industry 4.0 technology in the food sector aims to increase productivity more efficiently and better quality to improve competitiveness. People are increasingly aware to always seek information and use food products that will be consumed. Consumers really need accurate information about the status of a food product easily and instantly. Design and implement a mobile application that aims to improve consumer's information accessibility about food products. This application also allow users to share information about food products using android-based mobile devices. The system is designed used to get practical and easy solutions in verifying halal food products using QR(Quick Response) codes and geofencing technology. This system will be tested using SIT (System integration testing) which is a process used to check the speed, stability, scalability and use of software resources. This application, it is expected to make it easier for each user to know the halalness of food products as well as other information in order to consume these products. Geofencing technology also makes it easier for users to know the locations that provide the same product. Based on geofencing testing, the low MSE value (0.51) owned by WiFi network, 3G network has a much greater value (12.13).

Keywords : Geofencing, Halal Products, Mobile Application, QR Code, System Integration Testing.

INTRODUCTION

Indonesian population in 2010 was 237.6 million with the rate increasing every year. This means that every year there is a population increase of around 3.5 million people every year. If the growth rate is not underlined, it is estimated that Indonesian population in 2045 will be around 450 million people. Indonesia is a developing country with a high and dense population. In the world, Indonesia ranks 4th with the highest growth rate (Crystallography, 2016). According to a report by the Central Statistics Agency (BPS) based on the Mapping Indonesia 4.0 road map, the food and beverage



industry is one of the manufacturing industries prioritized for immediate digital transformation. The use of industrial technology 4.0 in the food sector aims to increase productivity more efficiently and better quality to improve competitiveness. Economic development, technology, and globalization have had a significant influence in the tourism industry, both at the global level and on a local and international scale. Economic growth has also influenced an increase in spending budgets in some families. Travel funds are well prepared for this at home and abroad. Information technology (IT) has made it easier to search for trending items in the world of social media. While globalization gives an idea of global tourism, it is becoming more and more within easy reach (Prastiti et al., 2023).

Transparency of food product information so that consumers become increasingly concerned about the origin and quality of the food products they consume. Easy and quick access to detailed information about food products is desired, such as nutritional information, raw materials, production methods, and other information related to product safety and quality. The many food products in circulation, whether produced by national or local companies or illegally produced food products, present a unique challenge. One of the problems is the ability of the public to choose good or licensed food products to be circulated to meet their needs (Fatoni & Irawan, 2019). The use of QR codes (Quick Response Code) as an alternative to digitizing food products displayed in the form of applications / software to help consumers introduce and expand information about food products around the community (Figana & Halimi, 2022). QR codes consist of black dots and white spaces arranged in a grid, and each element has a different meaning. This makes it capable of being scanned by an android and displaying the information it contains. Users only need an android and open the camera to get some information about the desired product. It is often difficult for people to find places that provide the same product/food in the neighborhood. Increasing consumer awareness with a mobile application for food product information that uses QR code-based geofencing technology, consumers can easily access real-time information about food products tailored to their location. This can increase consumer awareness about the origin, safety and quality of food products consumed (Sidik & Aryansyah, 2021).

Quick Response (QR) Code technology is deployed as a solution to provide a unique tag on each item that will store inventory information on the server via a local network. This allows for more efficient storage of inventory information. The implementation of this system will assist in managing the inventory process as well as enabling the storage of inventory information via QR Code. Thus, the process of recording and managing inventory can become more effective and efficient through the use of QR Codes to store inventory information (Kittiwan Nimkerdphol et al., 2018). Food product information mobile application with geofencing technology based on QR code is an application that utilizes geofencing technology and QR code to provide information about food products to users. Geofencing technology is used to determine



the user's location and provide information about food products available in the vicinity. QR codes are used as a method to access detailed information about the food products. This geofencing technology will be designed on software in the android operating system. This application can provide a location guide to the user where the food product is available.

LITERATURE REVIEW

The previous research was an Android-based application that uses blockchain technology to record transactions and information from various actors in the supply chain, such as breeders, companies, collectors, retailers, and consumers. This application can also track transactions and information about broiler chickens in real-time and transparently using the BatchID provided by the actors. One of the new alternatives now available to solve this problem is to utilize blockchain technology. Blockchain is a type of decentralized and distributed ledger used to store transaction records in the form of blocks. Each block in this blockchain contains information from all transactions in the system over a period of time and has a digital signature that can be used to verify the validity of the information associated with the previous and subsequent blocks (Usman et al., 2021).

The inventory management process still uses a manual approach in inventorying and recording goods. Therefore, the purpose of this inventory management system is to replace the manual approach by using web-based applications and also mobile device-based applications to collect inventory data. Within the framework of this system, Quick Response (QR) Code technology is used as a solution to provide a unique mark on each item that will store inventory information on the server through a local network. This allows for more efficient storage of inventory information. The implementation of this system will assist in managing the inventory process as well as enabling the storage of inventory information via QR Code. Thus, the process of recording and managing inventory can become more effective and efficient through the use of QR Codes to store inventory information (Kittiwan Nimkerdphol et al., 2018).

1.1 The Role Of Halal Food

In Islam, there are rules that regulate what is allowed (halal) and not allowed (haram) based on the Qur'an and Hadith (sayings and actions of the Prophet Muhammad). This makes the concept of Halal a very important thing in this religion. It is not only related to interactions between humans, but also to one's relationship with God. Eating halal food and avoiding haram food is part of Muslims' worship and demonstrates their adherence to their religion. The safe and secure use of food, cosmetics and medicines is the aspiration of all Muslims. Consumers must obtain legal certainty about the products they use. Halal processed products without haram (Christanto, 2022).

Halal status is a global symbol for ensuring food safety, quality and lifestyle. The data shows the need for certification and systems that ensure the integrity of the halal



status of products in society is very important. The safety and security of the use of food, cosmetics and medicines is the aspiration of all Muslims (Aziz et al., 2021; Rejeb, 2018; Shafii & Wan Siti Khadijah, 2012; Sidarto & Hamka, 2021; Zainuddin et al., 2020). Customers must obtain legal certainty about the products they use. Halal processed products without haram (Faridah, 2019). Halal law aims to achieve good for the people, both in this world and in the afterlife. The halalness of a product is an important need for consumers, especially those who are Muslim. Currently, many food products are processed with various scientific and technological techniques, which is a concern because not all products have halal certification. (Sayyidatunisa et al., 2020).

1.2 Quick Response Code (QR Code)

QR (Quick Response) codes are used to disseminate information that can be accessed through smartphones, digital tablets, and other electronic devices. QR Codes are two-dimensional images that depict data, mainly text. In the beginning, QR Codes evolved from one-dimensional barcodes to a two-dimensional form. QR Codes are often used in consumer advertising settings, commercial tracking, ticket sales, and marketing strategies. In addition, QR Codes are also utilized to verify the authenticity of diplomas quickly and accurately. (Fajriyah et al., 2022) .



Image 1. QR code

QR codes are created by following a specific protocol, which is the same as the one used for decoding (Fajriyah et al., 2022; Jain et al., 2021; Kittiwon Nimkerdphol et al., 2018). While QR code generation is a straightforward process, the main challenge lies in recognition with higher accuracy and speed. Obtaining information from QR codes in a real-world environment consists of three important steps: localization, image preprocessing, and decoding. Localization refers to detecting a QR code and its exact coordinates or location on an image. Image pre-processing is an intermediate step where the detected QR code image is enhanced to reduce blur, noise, distortion, angular perspective, etc. to enable accurate decoding. Decoding is the final step where information/data is retrieved and relies on the main standard architecture of the QR code. Maximum work and innovation has been done for the previous two steps, therefore, the review will focus on them with greater focus. (Jain et al., 2021).



1.3 Geofencing Technology

Geofencing is a technology used to monitor the movement of objects that can be androids, vehicles, and others using the Global Positioning System (GPS) satellite network. Geofencing defines certain geographical boundaries on a map (Ahmasetyosari & Fatimah, 2018). Geofencing is a feature in software or programs that utilizes global positioning system (GPS) or radio frequency identification (RFID) components to establish virtual geographic boundaries. The approach of collecting data using GPS is an advancement compared to traditional data collection methods. To access GPS positions, programming functions provided by Google Maps are required so that they can be integrated into the website or application being developed. The function is known as the Google Maps API (Sutanto et al., n.d, 2019).

1.4 Location Based Service (LBS)

Location-based services (LBS) refer to computer applications, particularly in mobile computing, that provide information based on the location of users and devices, primarily utilizing mobile portable devices such as smartphones and mobile networks. The continuous evolution of mobile devices and telecommunication technologies in recent years has resulted in significant advances in LBS. The service has gained popularity not only in outdoor environments across cities but also in indoor environments such as shopping malls, museums, airports, major transportation hubs, and various other spaces. LBS can be used in emergency services, tourism, navigation guidance, intelligent transportation services, entertainment (gaming), assistance services, health/fitness, social networking, and more. (Huang & Gartner, 2018).

LBS applications not only help to simplify people's daily activities and decision-making processes in space, but also generate a large amount of data on how people use, travel, and interact in the surrounding environment. Moreover, it can provide better insights to improve LBS applications that generate this data.

1.5 Google Firebase

Google Firebase is a platform developed by the Google company that integrates with all application development platforms such as android application development, iOS application development, website creation, hosting, and other functions and is even interoperable, meaning that it is used in different platforms simultaneously (Developer Training Team, 2019). Firebase is also relevant for iOS and web app developers. However, in the context of this course which focuses on android app development, the subject matter is only focused on utilizing Firebase in android apps. As an android developer, it is common to use Android Studio to build apps, but have the option to incorporate Firebase to enrich app features, expand user reach, conduct app testing, source revenue from the app, and analyze app usage.

1.6 Android Studio

Android studio is the official IDE (Integrated Development Environment) for Android application development and is open source or free. The launch of Android Studio was announced by Google on May 16, 2013 at the Google I/O Conference event



for 2013. Since then, Android Studio has replaced Eclipse as the official IDE for developing Android applications. Android studio itself is developed based on IntelliJ IDEA which is similar to Eclipse along with the ADT plugin (Android Development Tools)(Sebastian Usin, 2021). Features of the Android studio project are based on Gradle Build, refactory and fast bug fixes, a new tool called "Lint" is said to be able to quickly monitor the speed, usability, and competitiveness of the application. Supports Proguard and App-signing for security. Has an easier android application GUI. Supported by Google Cloud Platfrom for every application developed.

1.7 Google Maps

Google Maps is one of the most striking and highly anticipated innovations in the history of technology. It was developed by Google Inc. the largest technology company in the United States. It allows individuals to navigate and find the shortest and most efficient path to their destination. Based on recent survey results, Google Maps has been used by nearly 64 million people. In addition, Google Maps continues to improve its functionality by adding new features such as street view, location information of hospitals, cafes, police stations, and many other useful features. The algorithms, techniques, and technologies used by Google Maps are modern and sophisticated(Mehta et al., 2019).

1.8 Sqlite

SQLite is a data storage library that works in a single way, which does not require many external libraries, accessing databases in a Serverless manner, which can read and write directly from database files without the need for a centralized server. The process of implementing a database using SQLITE for the Android environment was developed and discussed. SQLite supports the same standard relational database commands as MySQL database, these commands consist of Data Definition Language (DDL), Data Manipulation Language (DML), and Data Query Language (DQL) (Setiyadi & Setiawan, 2018).

Data Definition Language (DDL) is a subset of SQL (Structured Query Language) that is used to define and manage the structure of a database, including the creation, modification, and deletion of database objects. DDL statements are not concerned with the actual data stored in the database, but rather with the database schema, which includes tables, indexes, constraints, and other structural elements. DDL is used to specify CREATE, ALTER, DROP, TRUNCATE.

Data Manipulation Language (DML) is a subset of SQL (Structured Query Language) used to manage and manipulate data stored in a relational database. Unlike Data Definition Language (DDL), which is focused on defining and managing the structure of the database, DML is concerned with the actual data within the database. DML allows operations are SELECT, INSERT, UPDATE, and DELETE.

Data Query Language (DQL) is a subset of SQL (Structured Query Language) that is specifically focused on querying and retrieving data from a database. DQL consists of



SQL statements used to retrieve information from one or more tables in a database. The primary and most commonly used DQL statement is the SELECT statement, which allows you to define queries to retrieve specific data based on certain conditions and criteria. The main purpose of DQL is to retrieve information from a database in a structured and organized manner. DQL statements are not concerned with the creation, modification, or deletion of database objects or data but rather with reading and presenting the data stored in the database.

RESEARCH METHODS

In this research there are several stages that must be done before actually creating the system. The first research is the development of research concepts based on the bibliography. Furthermore, research planning includes designing hardware and software systems.

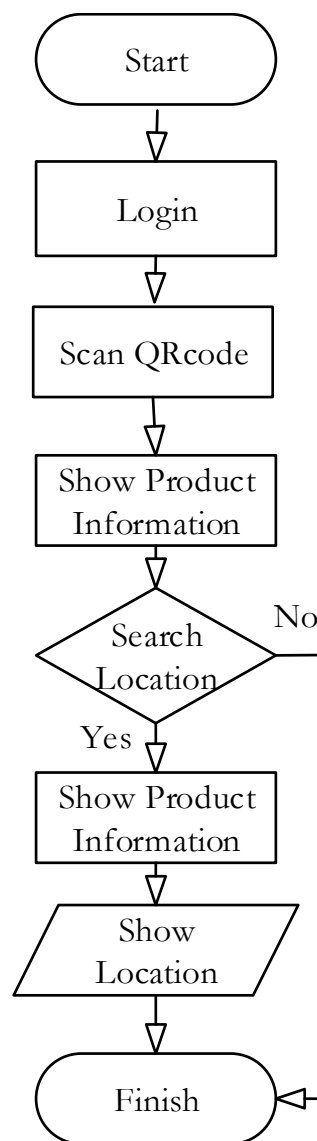


Image 1 Login Flowchart



Based on the image, the user flow can be explained. First the user opens the QR code application on their mobile device. Next the user selects the scan QR code option. Then the application opens the device camera to scan the QR code. Then, the QR code scanner object receives the scanned code and decodes it. The QR code scanner sends the decoded information to the app. The application displays the information to the user. Below is the application login flowchart performed by the application user.

2.1 Design of Admin Application System

In this sequence diagram, there are three main objects: User, QR Code Scanner, and QR Code Generator. The user interacts with the Scanner to scan the QR code and with the Generator to generate a new QR code. The sequence diagram shows the steps involved in scanning a QR code.

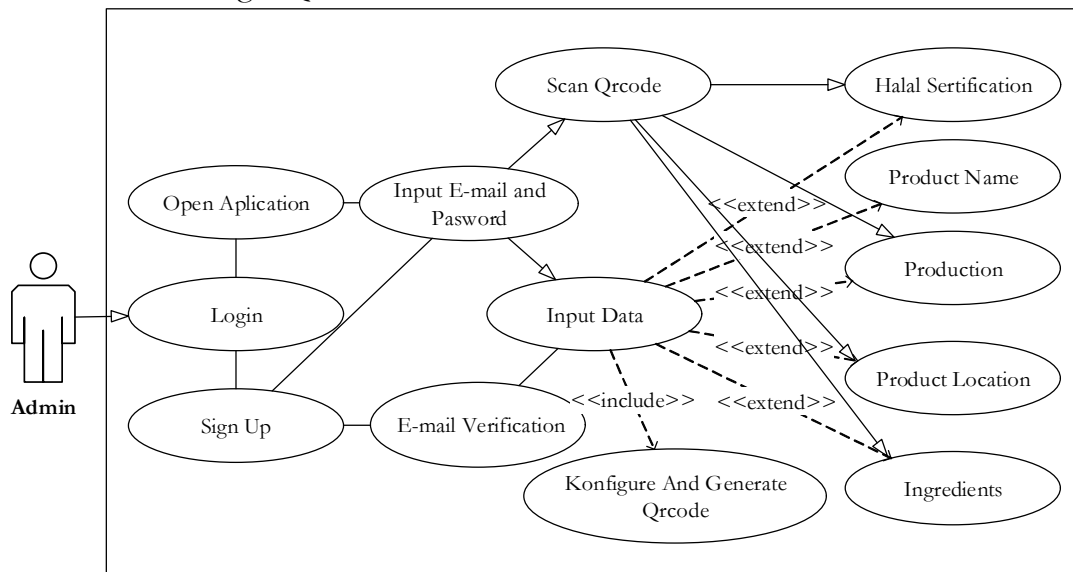


Image 2 Use Case Diagram of Admin

First the admin opens the QR code application on the mobile device. Then, the admin logs into the app to access the scan QR code feature and generate a new QR code. Next, the admin selects the scan option or input product information data. The application opens the device camera to scan the QR code. Then the admin inputs product data according to the information that has been obtained. The QR code generator receives data to generate a new QR code. The QR Code Scanner object receives the scanned code and decodes it. The QR Code Scanner sends the translated information to the application. The application displays the information to the Admin.

Login process by the user. In this login sequence diagram, the user performs a login action by filling in email and password information. Next, the system validates the database to check whether the email and password entered are registered. If registered, the process will continue to the next step by giving a success message to the user as a sign of successful login. But if the email and password are invalid, the system will provide a message stating that the email and password authentication was unsuccessful.

2.2 Design of User Application System



The section that explains the registration of a new account, starting with filling out the registration form, including email and password, then a check will be made on the database, if the signup data is valid, that is, the signup data is in accordance with the procedure for filling in the sign up data, the application will give a message that the creation of a new account has been successful. If the data is invalid then the user will receive a message that the data authentication failed.

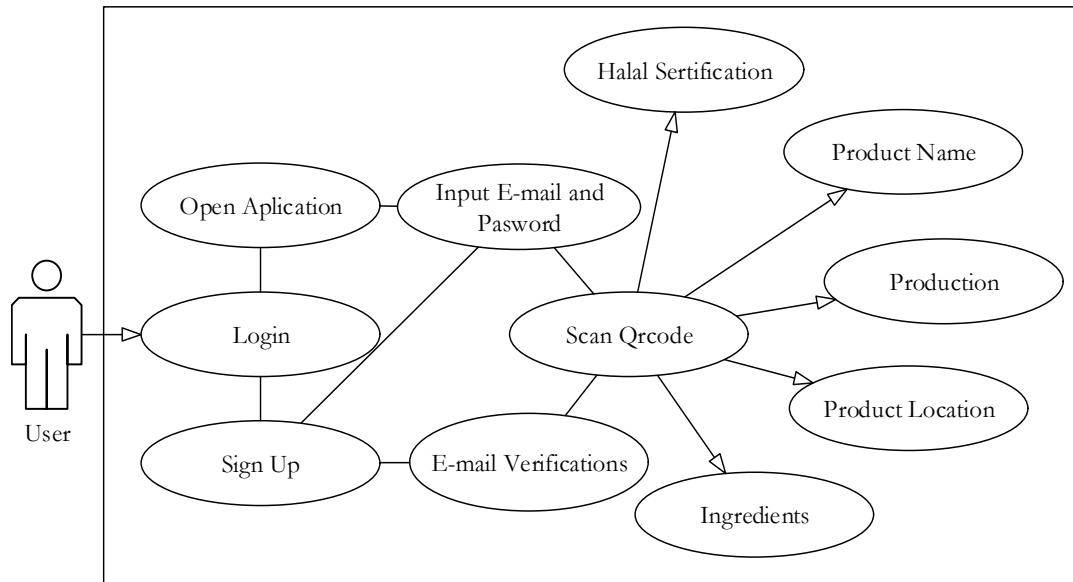


Image 3 Use Case Diagram of User

The flow carried out by the user opens the QR code application on their mobile device. first the user logs in to the application to access the QR code scan feature. Then, the user selects the scan option. The app opens the device camera to scan the QR code. The QR code scanner receives the scanned code and translates it. Next, the QR code scanner sends the translated information to the application. Then the application displays the information to the user.

2.3 System Integration Testing

Integration testing is a very important step in software testing. Existing methods evaluate stubbing costs for class integration test orders by only considering direct relationships between classes such as inheritance, aggregation, and association, but those methods. Eliminates indirect relationships between classes caused by control coupling, which can also affect test orders and stubbing costs. (Jiang et al., 2021). The following are the steps in conducting workflow integration testing:

1. Identify the workflow or business process to be tested.
2. Identify all system components involved in the workflow.
3. A test scenario that includes all interactions between system components in the workflow.
4. Prepare the data and test environment to test the test scenario.



5. Test scenarios and record all interactions that occur between system components.
6. Evaluate the test results and help resolve any issues or bugs found.

RESULT AND DISCUSSION

This chapter contains research results, source code, and application forms. After that, application integration testing is carried out by taking samples from application testing and evaluating whether the application can be used. This chapter includes the hardware used, the software used, application deployment, client application planning and system management application deployment, and system testing. All application testing processes require an Internet connection. Starting from application creation, database input, and system testing of the finished application. Internet connection is needed so that there is no error response from the system.

Observations related to product data collection and where products are sold. The products used are typical souvenir products in packaged form and have also obtained a PIRT (Home Industry Food) number that has gone through the process from BPJPH (Halal Product Guarantee Organizing Agency). Taking some products to be used as sample data for product information in the application. The product list is the original product processed by the Madurese community which has been distributed to various regions in Madura and surrounding areas.

3.1 Hardware

The hardware used in the development of applications and the application testing process includes:

NO.	HARDWARE	DESCRIPTION
1	LAPTOP	LENOVO
	PROCESSOR	AMD A4-9125 RADEON R3, 4 COMPUTE CORES 2C+2G 2.30 GHZ
	SSD	500GB
	RANDOM ACCES MEMORY	4 GB
2	HANDPHONE	INFINIX SMART NFC
	PROCESSOR	UNISOC SC9863A (28NM)
	RAM	2 GB
	MEMORY INTERNAL	32 GB

3.2 Application Testing

The application logo is made using the CorelDraw application. Application testing is done by taking samples from several participants of android cellphone users who are connected to the Internet. Testing this application uses 2 Internet networks, namely cellular telephone data connections and WiFi networks. Users and Admins fill out the signup form to get an account and access the application.





Image 4 App Logo for Admin



Image 5 App Logo for User

Storage of all product information that has been added through the halal product application using hosting. A service provided by a web hosting provider that allows application data to be accessed and available online via the Internet. In this case all data including the MySQL database, is hosted on a computer server operated by the hosting provider. The hosting stores all image files and databases, and provides the server resources required to run the application. The hosting is accessible online.



Image 6 Login Page



Image 7 Form Sign Up



Image 8 Admin page



Image 9 Scan QRcode



Image 10 Input Product Information



Image 11 Add Longitude and Latitude



Image 12 Add Location



Image 13 Product Information



On the login page admin input data in the form of e-mail and password. If the admin does not have an account then select Register. On the SignUp Form page the admin creates or registers an account to be able to log into the application. By completing the email and password. On the admin page, the activity page adds product information as a whole by selecting Create New QRcode. Admin chooses Scan QRcode when editing previously created product information. Admin scans the QRcode to edit the product location on the scan QRcode page. On the product data input page all product information is added. For the blue box button SELECT FROM GALLERY serves as a command to enter product photos. Next select UPLOAD IMAGE TO SERVER to save the photo data.

Add longitude and latitude page to add the location point of the product on sale. Adding locations can be done manually by entering longitude latitude numbers and automatically by looking at Googlemaps then clicking on the product location point. Admin can edit the product location after scanning the QRcode on the edit location page. Product information page that includes product photos, QRcode reload, coordinate reload, locations where products are sold

3.3 Testing e-mail data input

E-mail contains the "@" symbol. When the application login or sign up does not use @gmail.com the application does not respond to commands and the Sign in and sign up buttons are not displayed in the application. When entering a registered e-mail and entering the wrong password. The application will give a warning to the user, namely by appearing "incorrect login data". There is no limit to entering the wrong password, as long as the password is correct the user can log in to the application and scan the QRcode. E-mail input that has not been registered in the application cannot log in. The application gives a warning to the user that the login data is incorrect. The following is the application response when logging in and signing up with several ways of testing.

1. Entering an email without the "@" symbol. This causes the user to be able to log in because it does not meet the requirements of an email which generally contains the "@" symbol. The application does not display the sign in button.
2. The user has entered the email and password according to the login requirements. So that the sign in button appears for further scanning the QR code that the user wants.
3. When the user enters the wrong email or password. The app will notify the android screen that "Incorrect Login Data". When the password is wrong repeatedly, the application does not block the email. As long as the user enters the correct password, the user can login to the application. This "Incorrect login data" notification also appears when the email entered is an email that has not been registered with the system.
4. Experiment on the sign up form page or the page to register email. When the user enters the wrong email or password, the application does not display the sign up button. Which means the user cannot register an email and cannot scan the QR code.
5. Experiment on the sign up form page when the user enters an email that was previously registered but is registered again. The application displays a notification on the android screen "the email is already registered".

3.4 Generate QRcode



Users can rescan the QR code of the desired products. By selecting Rescan QR code. Product location coordinates can be reloaded to increase the accuracy of the location point. Users are facilitated only by using an android phone that has a camera available. Old-fashioned android types have difficulty reading QR codes because camera quality and dim lighting cause QR codes to be difficult to read or unreadable.

The process of making QR codes listed on halal products through the halal product information mobile application. In the process of generating QR code, this mobile application requires the help of a second party, namely the web QR code generator provider. The following are the stages of making a QR code, including:

1. Select the "Create New QRcode" menu. This menu contains select product images and upload images to the server.
2. Admin fills in the QR code String (code to create/generate Qrcode) and product information data from product name, manufacturer, certification number, and composition.
3. Choose save on the application screen.
4. After that to create a QR code. Admin opens a web that provides online QR code generation, here the author uses (<https://www.the-qrcode-generator.com/>) which is one of the online QR code generation webs.
5. To generate QR code, the admin chooses the Free-text type which means entering the QR code string in the form of initials or code that has been created in the application. Each product has a different QR code string.
6. After entering the QR code string has been registered, then the QR code string can be generated and the QR code appears to be scanned.

3.5 Testing the application of geofencing technology in the applications

As for the admin's way of adding the coordinates of the location of halal food products. To be able to access the application and edit all information using a special admin software. All information is uploaded using an Internet connection. Here are the steps to add product information. The application display is in the form of maps, columns for adding longitude latitude and shop names. Adding longitude latitude can be done manually and automatically... Adding longitude latitude can be done manually and automatically. Here's how to add it:

- a) Manual: the admin adds the product location point by typing the longitude latitude numbers that have been previously owned.
- b) Automatic: the admin is at the location of the product being sold directly by centering the map point on the android screen so that the longitude latitude of the store immediately appears.

Geofencing testing on the author's halal food product mobile application found the level of accuracy of the map results with the location of the product being sold. Error for each point or element in the application results and Ground Truth, calculation of the error or difference between the value generated by the application and the Ground Truth value. This can be done using various metrics such as Mean Absolute Error (MAE), Mean Squared Error (MSE).

Mean Absolute (MAE) is a measure of the average absolute difference between the predicted values and the actual values. It quantifies the magnitude of errors in a model's predictions. Mean Squared Error (MSE) measures the average of the squared differences



between predicted values and actual values. It emphasizes larger errors more than smaller errors since it squares the differences.

Tabel 3
MAE and MSE Calculation

ENVIRONMENT	MAE			MSE		
	3G	4G	WIFI	3G	4G	WIFI
RURAL	2.51	0.31	0.97	6.30	0.10	0.94
	2.42	0.72	1.22	5.86	0.52	1.49
	1.34	0.34	1.04	1.80	0.12	1.08
	1.23	0.23	1.13	1.52	0.06	1.28
CITY	2.34	0.94	0.14	5.48	0.89	0.02
	1	1.34	0.04	1	1.78	0.00
	2.3	0.53	0.23	5.29	0.28	0.05
	1.45	0.45	0.15	2.10	0.20	0.02
OBJECT WALKING	3.45	1.65	0.85	11.90	2.72	0.72
	5	1.05	0.35	25	1.10	0.12
	5.64	2.04	0.64	31.81	4.16	0.41
	6.89	2.49	0.09	47.47	6.20	0.008
AVERAGE	2.97	1.01	0.57	12.13	1.51	0.51

Data was collected in 3 types of environments: rural, urban, and when the user is in a walking position. With a sample of 4 product sales locations. From the above results it can be concluded that the use of wifi and 4G networks has a higher accuracy of location points. The low MSE value (0.51) owned by the WiFi network indicates that the application is in good prediction and runs according to its proper function.

The MSE generated by the 3G network is much larger (12.13) than the other networks due to the less precise accuracy of the product location. With this, the use of 3G networks is not recommended so that application users cannot find the location point accurately. The use of 3G network is not recommended.

3.6 Discussion of overall results

Analysis of the results of the discussion about the mobile application of food product information with QR code-based geofencing technology can be seen from various aspects such as benefits, advantages, and development potential. Other points to consider include. This application allows consumers to easily access food product information by simply scanning the QR code. This can help consumers in making more informed decisions. Geofencing can be used to ensure that food product information is only available at specific physical locations such as stores and product sales outlets. This can help avoid misuse of information or product image pollution. This application can be used to support local food products by providing information about these products to consumers who are nearby.

Halal food product information mobile application with QR code-based geofencing technology. The QR code concept allows users to interact directly with the product, see additional information such as product origin, processing method, and product sales



location. Geofencing allows monitoring of product and user locations, which can be used to analyze consumer patterns and enable more effective marketing strategies. Ease of Implementation QR code and geofencing technologies are relatively easy to implement in mobile applications. Integration is an important aspect in developing food product information mobile applications with QR code-based geofencing technology.

CONCLUSIONS

Based on the results obtained from system design and testing of halal food product information mobile applications with QRcode-based geofencing techniques and can be concluded. The design of the application design carried out has a final appearance that facilitates the process of providing information to users appropriately. This halal product mobile application has 2 core applications, namely user applications and admin applications. Both applications have different tasks. The user application has a function as a presenter of information to the user. While the special admin application functions to add all product information to be displayed to the user. Admin and application users need to log in before using the application. The halal product mobile application requires an android that has a camera to be able to scan product QR codes.

Halal product information mobile application gives product information to the user in the form of product images, store names, and store locations along with the distance traveled by the user from the user's location point to the location where the product is sold. The use of geofencing techniques in the application can show the point where the product is sold. Users can also find out the distance that must be traveled from the user's location point to the intended store.

OVERVIEW

- Ahmasyosari, A. S., & Fatimah, T. (2018). Aplikasi presensi siswa pada PT. Samudera Anugerah menggunakan metode geofencing dan perhitungan jarak menggunakan algoritma euclidean distance berbasis android. *Skanika*, 1(2), 481–485.
- Aziz, F., Setyorini, R., & Hasanah, Y. N. (2021). Analisis Halal Supply Chain pada Usaha Mikro Kecil Menengah (UMKM) Makanan di Kota Bandung. *Jurnal Ilmiah Ekonomi Islam*, 7(1), 293. <https://doi.org/10.29040/jiei.v7i1.1936>
- Christanto, G. (2022). *Design of Halal Food Supply Chain Management Based on Web and Blockchain Using Public Rinkeby Ethereum Network*. August. <https://doi.org/10.13140/RG.2.2.32165.58088>
- Crystallography, X. D. (2016). 濟無 No Title No Title No Title. 1–23.
- Developer Training Team, G. (2019). Android Developer Fundamentals Course- Concept Reference. *CIREN - Open Access Proceedings Journal*, 2019, 6–457.
- Fajriyah, R. F., Tyas, F. A., & Basir, A. (2022). Aplikasi Labeling dan Tracking Aset Menggunakan QR Code Berbasis Web di STMIK Muhammadiyah Paguyangan Brebes. *Jurnal Teknik Informatika Dan Sistem Informasi(JURTISI)*, 2(1), 34–40.
- Faridah, H. D. (2019). Halal certification in Indonesia; history, development, and implementation. *Journal of Halal Product and Research*, 2(2), 68. <https://doi.org/10.20473/jhpr.vol.2-issue.2.68-78>



- Fatoni, F., & Irawan, D. (2019). Implementasi Metode Extreme Programming dalam Pengembangan Sistem Informasi Izin Produk Makanan. *Jurnal Sisfokom (Sistem Informasi Dan Komputer)*, 8(2), 159–164.
<https://doi.org/10.32736/sisfokom.v8i2.679>
- Figana, D., & Halimi, I. (2022). Perancangan Sistem Deteksi QR Code Label Pada Kemasan Produk Bagging Machine. *Seminar Nasional Teknik Elektro*, 7, 7–9.
<http://prosiding.pnj.ac.id/index.php/snte/article/view/4386>
- Huang, H., & Gartner, G. (2018). Current trends and challenges in location-based services. *ISPRS International Journal of Geo-Information*, 7(6).
<https://doi.org/10.3390/ijgi7060199>
- Jain, V., Jain, Y., Dhingra, H., Saini, D., Taplamacioglu, M. C., & Saka, M. (2021). A systematic literature review on qr code detection and pre-processing. *International Journal on Technical and Physical Problems of Engineering*, 13(1), 111–119.
- Jiang, S., Zhang, M., Zhang, Y., Wang, R., Yu, Q., & Keung, J. (2021). An Integration Test Order Strategy to Consider Control Coupling. *IEEE Transactions on Software Engineering*, 47(7), 1350–1367. <https://doi.org/10.1109/TSE.2019.2921965>
- Kittiwat Nimkerdphol, D. R., Rd, N., Amphoe, T., Luang, K., Wat, C., & Thani, P. (2018). Inventory Management System Using Qr Code on Android a Case Study in Computer Engineering Department 1 Renza Ilhami Rizqi, 2 Nurul Azizah Rohma. *Journal of Electrical Engineering and Computer Sciences*, 3(1), 381–388.
- Mehta, H., Kanani, P., & Lande, P. (2019). Google Maps. *International Journal of Computer Applications*, 178(8), 41–46. <https://doi.org/10.5120/ijca2019918791>
- Prastiti, N., Rahmawati, D., Endharta, A. J., & Alunanika, D. (2023). HALAL PRODUCT TRACEABILITY SYSTEM MODELING USING INTERPRETIVE STRUCTURAL MODELING (ISM) IN BANGKALAN HALAL INDUSTRIAL AREA *Sistem Informasi, Fakultas Teknik, Universitas Trunojoyo Madura Teknik Elektro, Fakultas Teknik, Universitas Trunojoyo Madura*. 21–31.
- Rejeb, A. (2018). Halal Meat Supply Chain Traceability based on HACCP, Blockchain and Internet of Things. *Acta Technica Jaurinensis*, 11(4), 218–247.
<https://doi.org/10.14513/actatechjaur.v11.n4.467>
- Sayyidatunisa, Wahidah, A. I., Alam, M. N., Mayasari, A. E., & Agya, H. P. (2020). Digitalisasi Halal Food Menggunakan Platform Design Toolkit. *Indonesian Journal of Halal*, 3(1), 64–68.
- Sebastian Usin, E. (2021). Hasil pengembangan Aplikasi Dengan Android Studio. July.
- Setiyadi, A., & Setiawan, E. B. (2018). Information System Monitoring Access Log Database on Database Server. *IOP Conference Series: Materials Science and Engineering*, 407(1). <https://doi.org/10.1088/1757-899X/407/1/012110>
- Shafii, Z., & Wan Siti Khadijah, W. M. N. (2012). Halal traceability framework for halal food production. *World Applied Sciences Journal*, 17(SPL.ISS1), 1–5.
- Sidarto, L. P., & Hamka, A. (2021). Improving Halal Traceability Process in the Poultry Industry Utilizing Blockchain Technology: Use Case in Indonesia. *Frontiers in Blockchain*, 4(December), 1–8. <https://doi.org/10.3389/fbloc.2021.612898>
- Sidik, R., & Aryansyah, K. (2021). Implementasi QR Code pada Pengembangan Sistem Informasi Presensi Lokakarya dan Seminar. *Jurnal Manajemen Informatika (JAMIKA)*, 11(2), 88–101. <https://doi.org/10.34010/jamika.v11i2.4676>



- Sutanto, A. T., Palit, H. N., & Lim, R. (n.d.). *8039-15147-1-Sm. 2-7*.
- Usman, M., Hermadi, I., & Arkeman, Y. (2021). Design of Broiler Supply Chain Traceability System through Blockchain-based Android Application. *Systematics*, 3(3), 295–308.
- Zainuddin, N., Saifudin, A. M., Deraman, N., & Osman, A. A. (2020). The effect of halal traceability system on halal supply chain performance. *International Journal of Supply Chain Management*, 9(1), 490–498.

