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JOURNAL OF APPLIED SMART ELECTRICAL NETWORK AND SYSTEMS (JASENS)

Vol. 3 No. 1 (2022) 9 - 15 ISSN Media Elektronik: 2723-5467

Implementation Of Location Base Service Method Using Wi-Fi Network For Object Recognition At Museum

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Abstract

The museum that is currently being built is used as a place to manage existing historical objects, because real historical objects are easy to know when in the museum. The current management of the museum still uses a manual system, where visitors come to the museum and then see the historical objects in the museum. Nowadays, with the rapid development of the times, the use of advances in information can be used whenever and wherever the user is. Location-based services in museums can be used to develop object recognition systems implemented in museums. In this research, a Location Base Service (LBS) system will be created that uses an android application that is connected to a server to make it easier to study historical objects. The android device will transmit the current position signal received by the Access Point. The Android application functions as a viewer of nearby historical object description objects. When the user wants to observe a nearby historical object, the user will display a video about the object to introduce nearby objects. To support the Location Base Service (LBS) system, several Access Points to track users via wireless connected to Android devices.

Keywords: Android, Augmented reality, Location based service, Museum, WIFI network.

Diterima Redaksi : 15-05-2022 | Selesai Revisi : 12-06-2022 | Diterbitkan Online : 30-06-2022

1. Introduction

The development of the museum is used in the field of education for the benefit of disseminating historical information to people who do not understand. The museum management system still uses a conventional system, which can make visitors less interested in coming to the museum. Currently, not many museums have been digitized which causes museum visitors to get lost and do not know where to go [1].

Currently, the management of museums in Indonesia uses many classical methods such as placing objects that are not classified, maps of museums near the counter, and descriptions of objects on the board [2]. Location Based Service (LBS) is a service that can access location information, based on an electronic map containing latitude and longitude so that the actual position appears [3]. Many solutions are offered to provide indoor location-based services, for example tracking a person or device in an office building. The location determination system has an accuracy that can affect the quality and effectiveness of the LBS itself [4]. Currently, many are using Augmented Reality in various fields such as education, entertainment, medical, robotics, manufacturing and so on. Augmented Reality (AR), is a technology that combines two-dimensional and or three-dimensional virtual objects into a real three-dimensional environment and then projects these virtual objects in real time [5]. However, to run Augmented Reality properly, a 5.0 Megapixel to get good results.

GPS has enormous benefits on the systemnavigation, but this system has low accuracy when the user is in a room or building[6]. Based on the user's position allows the application of LBS to find important tourist locations such as restaurants, shops, hotels, historical-cultural sites of interest, verify weather and traffic conditions, book tickets for travel or cultural events, calculate routes, or obtain tourist information[7]. LBS give the possibility of a two way communication and interaction [8]. The advantages of using W-LAN over Wire LAN are quite clear, namely, it does not require very expensive cable installation for a large or small office, besides that it can be accessed anywhere without space limitations [9][10]. To connect with Wi-Fi, it takes a device, namely an Access Point in the form of a Hub or Switch that serves to connect the local network with wireless or wireless networks, Bluetooth or other communication networks [11]. Automatically the device used by the user will move from one access point to another without the need to disconnect [12]. SQLite is

an embedded SQL database engine. Unlike most other SQL databases, SQLite does not have a separate server process. SQLite reads and writes directly to ordinary disk files. A complete SQL database with multiple tables, indices, triggers, and views, is contained in a single disk file [13].

2. Methods

2.1. Research Design

This research uses the LBS (Location Base Service) method which will be described in Figure 1.It shows the stages of research that will be carried out according to Figure 1. The first stage is conducting a literature study. The literature study was carried out by reading previous research journals that were related to the research to be carried out. The second stage is planning the system that will be made for the research carried out and knowing what components will be used. The third stage is the design of the system that will be used in research. The devices used are Android Applications, Database Servers, and Access Points. The fourth stage is testing the system that has been designed, so that it can see the suitability of the tool with the design of the tool that has been made. The fifth stage is to analyze the results of making the tool to find out whether the system designed is appropriate and can work properly. The seventh stage is making conclusions from the tools that have been made. Conclusions are made based on tools that have been analyzed and can work properly. The eighth stage is making a report from the analysis and conclusions that have been completed.

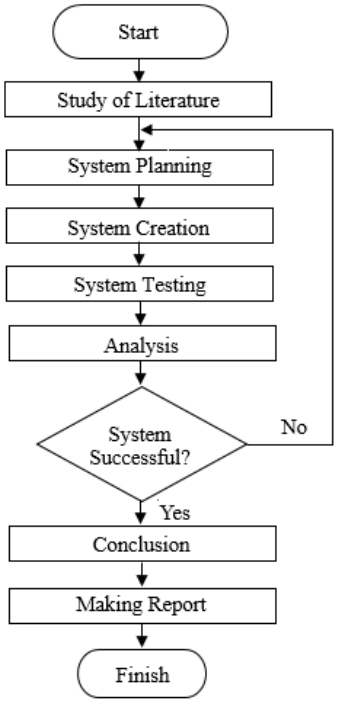

Figure 1 Research Flowchart

2.2. System Design

Design of the Location Base Service system to be made is shown in Figure 2.

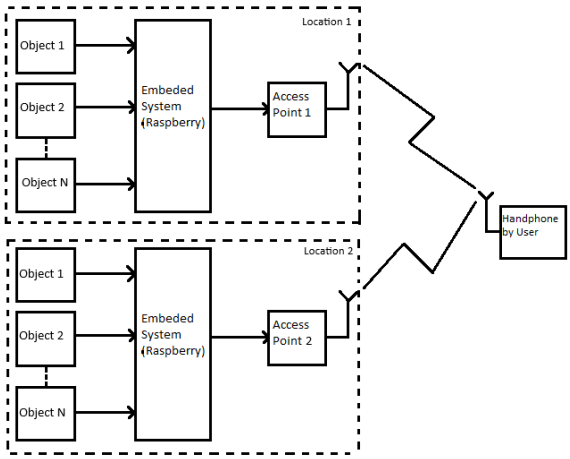

Figure 2 Block Diagram of the System

In Figure 2 there is a block diagram of the system that makes Android Applications component display in this system. This application will display various objects in the museum. Before being used in the museum, the device must be connected to WIFI. The android application will display the main menu with various kinds, namely position, historical classification, and directions to the destination. This application also displays additional indicators, namely an appeal to connect the device to WIFI, a back button to the main menu, a map of the museum, and the position users .position menu will display the user 's current position and several options for the nearest available object will be displayed. In the history description menu, the application will prompt the user to point the device's camera at the target image that supports the use of Augmented Reality.

Access Point is a device in a computer network that serves to create a local wireless network or referred to as a Wireless Local Area Network (WLAN). Access Point will connect android application with Database Server. The installation Access Point in the museum will take into account the range of the Wi-Fi that is transmitted. Access Point can determine the user's location through signal strength from the distance of the current position to the Access Point.

In Figure 3 there is a mapping of locations that will be applied to this system. At the beginning of entering the museum, visitors will be connected to the nearest AP. Inside the museum will be divided into 5 rooms, namely 4 locations containing objects and 1 toilet. In each location, there is 1 AP and 2 objects arranged. Locations 1 and 2 are in the right row of the museum. While the left row is filled with locations 3 and 4.

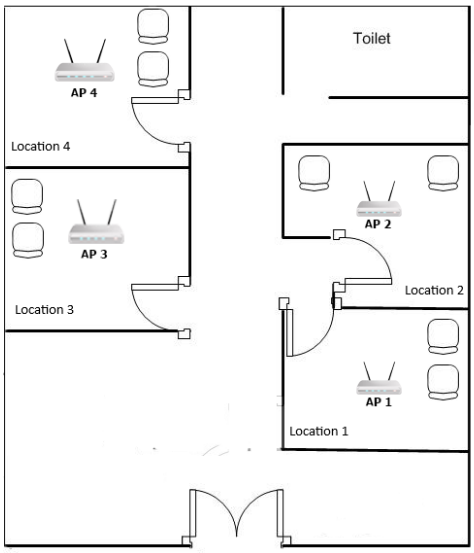

Figure 3 Mapping Locations

2.3. Design Database

In Figures 4 and 5 this system is designed using a database MyQL server as object data processor and user as data sender and receiver. The database server here stores descriptions of objects in the museum. The database in the Location Base Service uses a connection to the Access Point to send and receive information. Databases The server is accessed and stored using Raspberry Pi, while user accesses the database using the Android Application. user sends the object image information to confirm the object description data that matches the Database through Access Point the connected. The database server has a function to receive object image data sent from the user, then process the data by verifying the object image with the available video and sending the results to the user. In addition to being sent to the user, the results of processing object access data will be stored in the database.

Figure 4 Table Database

In Figure 6 Android applications function as displays on this system. In the mock up of the application, the user will be shown the home screen if the user is connected to WiFi provided by the museum. Once connected, the application can be used by tapping the screen to start the object search. Next, the history object will be displayed in the start menu. Selection of objects based on the user's location when it is connected to Access Point . The initial menu will display the object classification options available in the museum. In the classification of existing historical objects, there are historical objects that will be displayed next.2.4. System Flowchart and Parameters

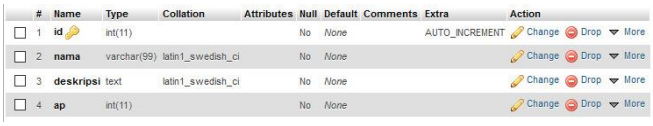

Figure 5 Table Contents Database

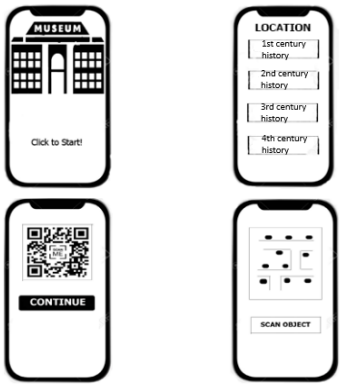

Figure 6 Mockup Applications

2.4. Flowchart System and Parameters

The working system of this design will be explained in the flow chart which will be shown in the flowchart in Figure 7.

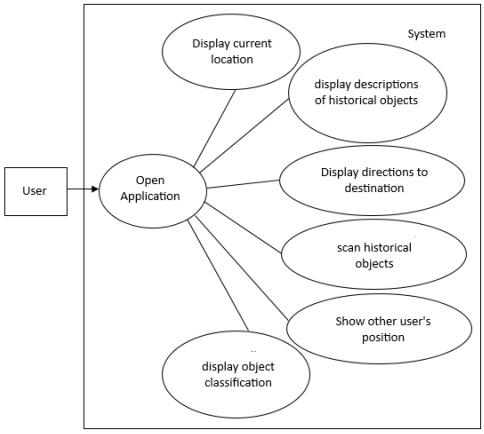

Figure 7 Use Case Diagram

In Figure 7 use case diagram, there are 6 application uses that will be provided. The first is that the user can display his current position, here the user will know his position while in the museum. The second, User can display a description of historical objects. When the user has determined the object's destination, the user can find out the description of the historical object using the output image, sound and/or video. Third, the User can find directions to the next destination. Users will get notifications to continue browsing historical objects in the museum and display directions. After that, User can scan history object. When the user has determined which object to study, the application will bring up the camera to scan the QR Code on the object. In addition, users can find out the position of other users. Users can be seen in

the app after connecting to WiFi. And lastly, User can find out the historical classification. When the user opens the main menu, the application will display various classifications of historical objects in the museum.

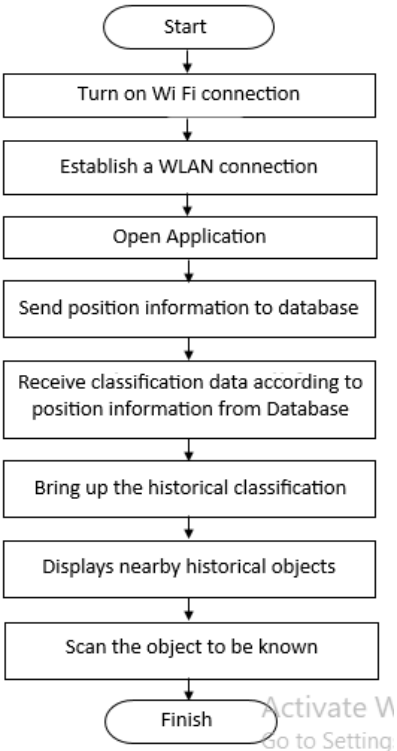

Figure 8 Flowchart Overall System

In Figure 8 will explain the overall system flowchart of the research procedure with the first step, namely the user activates the WiFi connection. WiFi connection is used for position information traffic media and object classification. After the user is connected to the WiFi provided by the museum, the user can open the museum application. When you enter the main menu, the application will send the user's current position data to the database to determine the historical classification according to the position by detecting the access point that is connected to the user. After the information data is processed in the database, the application will respond to the data about the historical classification according to the user's position data. The application will display the historical object classification information according to the user's position. After that, the application will display what objects are available according to the history classification. When you want to know an existing historical object, the application will access the camera used to scan the object by scanning the existing QR Code, so that the application can display a description of the object in the form of images, sound, and/or video.

3. Results and Discussion

This application is a display of museum visitors. Visitors can access the museum object mapping map when they open the application when the visitor is within a radius of the Access Point. At the beginning there is a map display menu in the museum, visitors can see the mapping of objects from the museum. The next process is to explore the object to be studied in the museum.

When a visitor opens the application, the first page appears on the homepage of the map of the museum, the position of the visitor, the direction of the road to be traversed. When selecting an object to study, visitors look for a classification from the list of available objects. If the visitor has found the classification in the object list, the application will show the location of the object and display the route to get to the object. Visitors can go directly to the location of the object after knowing the route to the object.

The device specifications used for testing the LBS system application with Redmi Note 4 mobile phone; Network: GSM / HSPA / LTE; SIM: DualSim; OS: v6.0 Marshmallow; RAM: 4GB; Screen: 5.5 inches; Front Camera: 5 MP; Rear Camera: 13 MP.

Figure 9 shows the rooms in the museum. In the top bar of the menu display there is an SSID with the name "Museum". Then there is the Mac Address, which is "14:cc:20:df:3a:0c" and the AP signal level is 4. The two rectangles in the middle are rooms that contain several historical objects. The room that has a red dot in the middle is the current position of the application user. At the bottom of the application, there is a “Direction” button which will display the route the user has taken to the desired place. Then the "List of Objects" button will display the objects available in the room.

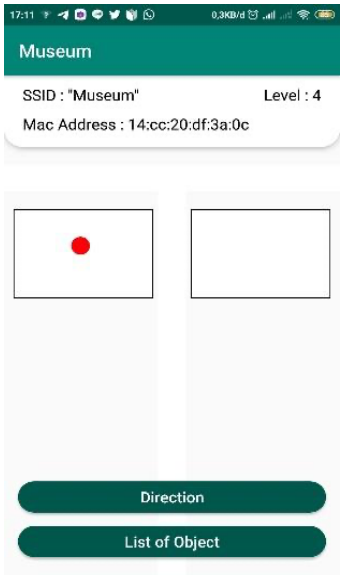

Figure 9 Display of visitor's initial menu

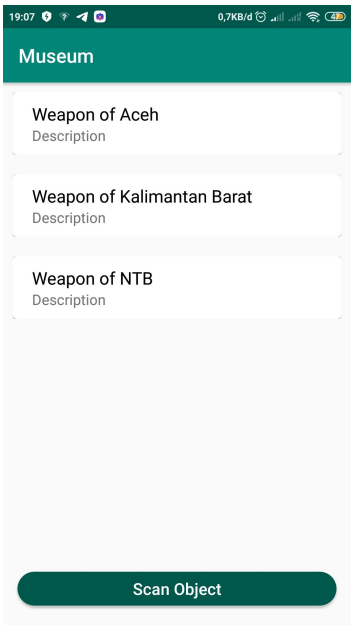

Figure 10 Display of Room Object List

Figure 10 is a list of historical objects in the museum room. If the user has determined the object to be known, the user must press the "Scan Object" button to find out the description of the object in the form of a short video. In the menu, there are 3 categories to choose from, namely weapons from Aceh, weapons from West Kalimantan, and weapons from NTB.

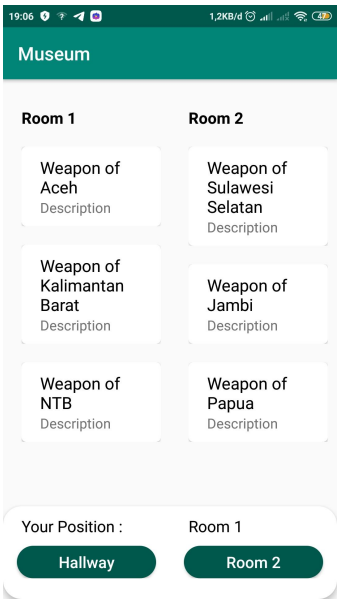

Figure 11 Display of directions to the museum

Figure 11 is a display of directions inside the museum. In the display, there are objects located in room 1 and room 2. In room 1, there are objects from Aceh Weapons, Jakarta Weapons, and NTB Weapons. Meanwhile, room 2 contains weapons from South Sulawesi, Jambi weapons, and Papua weapons. At the bottom, the application displays the user's position. Then there are 2 buttons "Hallway" and "Room 2". The “Hallway” button will direct the user to return to the starting place. While the "Room 2" button will direct the user to the location of room 2.

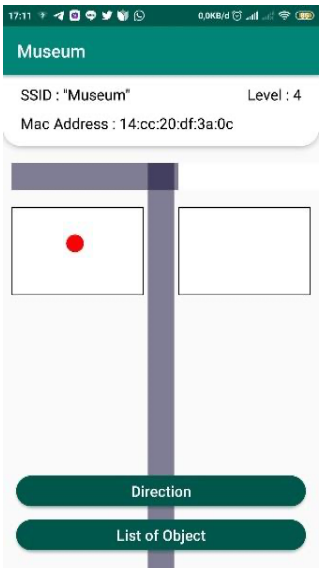

Figure 12 Display of the route traversed

Figure 12 displays a line indicating the user to pass. Users will follow the gray line to get to the desired place to the destination.

Figure 13 Video display on Vuforia

In Figure 13, the application displays a video description according to the object being scanned. The application will adjust the image on the object with database on the server. In the video " button pause which is used to pause the video being displayed and "repeat" serves to repeat the video from the beginning.

Test Time Pairing of the Location Base Service user will be in the range of each Access Point placed at three different points. The user's device will detect delay that occurs between the Wi-Fi connection connected to the user's device and the nearest AP. After the Time Pairing is carried out, the test results show various different values in each Access Point being tested.

Table 1 shows the time it takes to connect a user's device to the Access Point (AP). In the AP 1 experiment, the fastest time in Time Pairing was on the 11th experiment, which was 3.02 s with an average connected time of 3.447 s. In the AP 2 experiment, the fastest time in Time Pairing was on the 15th experiment, which was 3.49 s

with an average connected time of 4.339 s. In the AP 1 experiment, the fastest time in Time Pairing was on the 5th experiment, which was 3.02 s with an average connected time of 3,634 s.

Table I. Time Pairing Test Results

Experiment	AP 1	AP 2	AP 3
1	3.78 s	4.42 s	3.15 s
2	3.74 s	3.63 s	4.04 s
3	4.17 s	4.75 s	3.33 s
4	4.25 s	4.84 s	3.54 s
5	3.50 s	4.77 s	3.02 s
6	3.24 s	5.06 s	3.11 s
7	3.46 s	4.76 s	3.09 s
8	3.37 s	4.66 s	3.40 s
9	3.52 s	4.67 s	8.86 s
10	3.16 s	3.92 s	3.86 s
11	3.02 s	4.02 s	3.78 s
12	3.25 s	3.92 s	3.42 s
13	3.11 s	4.10 s	3.29 s
14	3.18 s	3.79 s	3.21 s
15	3.05 s	3.49 s	3.52 s
16	3.25 s	4.43 s	3.52 s
17	4.20 s	4.78 s	3.57 s
18	3.29 s	4.85 s	3.05 s
19	3.28 s	4.53 s	2.87 s
20	3.11 s	3.65 s	3.05 s
Average	3,447 s	4,339 s	3,634 s

Test Response Augmented in the Location Base Service, users will scan historical objects in the museum. When the user is near an object, the user can press the "Scan Object" button and the museum application will access an additional application, namely Vuforia. application Vuforia will access the phone's camera to scan images on objects. Then delay that occurs between the image scanning process and the application brings up a video of the object being tested. After several experiments, the data shows delay in each tested image scan. Here are the results of the Response Augmented Reality is shown in table 2:

Table 2. Test results for response augmented reality

Experiments	Response AR	Experiments	Response AR
1	6.85 s	11	3.01 s
2	16.36 s	12	4.52 s
3	22.08 s	13	5.44 s
4	2.04 s	14	2.55 s
5	12.90 s	15	2.75 s
6	41.48 s	16	6.68 s
7	15.97 s	17	6.54 s
8	2.03 s	18	1.78 s
9	3.66 s	19	2.63 s
10	2.17 s	20	2.16 s

Table 2 shows the results of the delay that occurs in the Vuforia in the Augmented Reality process. In the table, the first to seventh experiments have delay up to 41.48 s. Then on the eighth experiment until it was finished it had delay, which was under 7 s.

Test , the user application will display a route that directs museum visitors to the available objects. The design of the museum map is made into a classification or classification which is divided into two rooms. This testing process is carried out by calculating the delay in the application when the application displays the route to the museum room. After several experiments, the data showed delay almost the same Here are the results of the Response Augmented Reality is shown in table 3.

Table 3. Test results time direction

Experiment	Time Route	Experiment	Time Route
1	0.83 s	11	1.09 s
2	0.97 s	12	0.94 s
3	0.86 s	13	0.90 s
4	1.21 s	14	0.72 s
5	1.03 s	15	1.41 s
6	1.09 s	16	1.20 s
7	0.79 s	17	1.29 s
8	0.88 s	18	1.05 s
9	1.13 s	19	0.84 s
10	1.01 s	20	0.89 s

4. Conclusion

The LBS system makes it easier for visitors to identify objects in the museum. Visitors can find out the location of the available objects and know the description of objects through videos. In the tests carried out, the delay that occurs does not exceed 60 seconds and the delay can be reduced. The pairing delay time only reached 4,339 seconds on AP 2. Meanwhile, AP 1 and 3 had a small average delay of 3,447 and 3,634 seconds. Response Augmented Reality testing shows a high delay at the beginning of the experiment. However, the middle to the end of the experiment resulted in a low delay. In testing the route direction time, the delay data obtained is relatively stable with an average of 1.0065 seconds.

Android devices have a WiFi connection facility that can connect to an Access Point. The android device here has a function to detect the user's position based on the connection connected to the Access Point. Access points are also useful for mapping the position of the installed users spread out at three different points. Therefore, the LBS system can run smoothly by combining android and wireless applications.

The Android application is a display component on this system. Before being used in the museum, the device must be connected to the provided WiFi. The application will show a WiFi signal indicator to ensure the Location Base Service system can function properly. Each Access Point has a Coverage Area that is spread out within the museum. Access points here are useful for mapping the position of the installed users spread across three different points. Installation of access points that are spread out are aimed at making it easier to determine the position of existing visitors.

For future work, this system can be expanded not only for museum development, but also with other indoor places such as malls, traditional markets, etc. The LBS system is able to add a feature to detect the accuracy of the user's location in real-time. In terms of interface, the

application still looks simple and should get a better and attractive design. And the delay that occurs in testing time pairing and response augmented reality can still achieve smaller results.

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