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Geographic information system for mapping public service location

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Abstract. This article aims to analyze, design, and development public service location mapping system based on Geographic Information System (GIS). GIS technology is a useful information system used in making information systems for mapping areas and locations accurately so that it can make it easier for people to obtain information on the distribution of places of public services and facilitate the path to the site. Data used is sourced from external data and observational data in the field. The software development model uses the Rapid Application Development approach which consists of four phases namely, planning requirements, user design, construction, and cutover. The results of this study are applications for mapping the location of public services that have features of fast search, geo-maps, know the nearest public service, add data by users with the login feature via social media, and features easy access via Android smartphone. With the development of this application, hoped that it could provide benefits to facilitate and accelerate the community towards the location of public services without being limited by space and time.

1. Introduction

Public services are all forms of services, which in principle are the responsibility and carried out by government agencies or the private sector, in the context of efforts to meet the needs of the community and in the context of implementing the provisions of legislation [1]. If you see the culture of the city beforehand to obtain information on public service places, it is generally easy to get it based on recommendations and ask people who know the area, but in this way, it is only limited to certain people, and sometimes the information provided is not accurate.

Geographic Information System (GIS) is a specialized information system that manages data that has spatial information [2], while in a narrow sense GIS is a computer system that can build, store, manage and deliver information referring to geography in a database [3]. With the advancement of GIS technology combined with internet technology and mobile devices such as Android smartphones with Global Positioning System (GPS) features, it will undoubtedly make it easier for people to get to the location of public services, and indirectly change the culture of society to get information and public services quickly.

Research work related to the application of GIS technology both web-based and mobile-GIS in various fields have been carried out such as, GIS application for reforming space and the area of

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government city [4], mobile GIS application for inventory [5], volunteered GIS for public lands management [6,7], mapping the handling of disaster locations [8–10], Android, GIS and Web Base Project [11,12], even to the implementation of GIS applications for mapping service locations for pregnant women [13]. Based on the previous work it was concluded that GIS technology is a useful information system used in making information systems for mapping regions and locations accurately, especially for mapping the distribution of public service locations, so that it can facilitate the public to obtain information on the site of public services and facilitate the route to the place.

This article aims to analyze, design, and development public service location mapping system based on Geographic Information System (GIS) with a system development method using Rapid Application Development. The data needs of the public service location used in the application development work are sourced from external data and field observation data, with the limitation of only the data public service location in the province of West Java, Indonesia. The benefits generated from this work are software applications to make it easier for people to reach out and obtain information on public service places quickly.

2. Method

To achieve the goal of designing a Geographic information system for mapping public service location, the process is carried out based on the activity stages in figure 1.

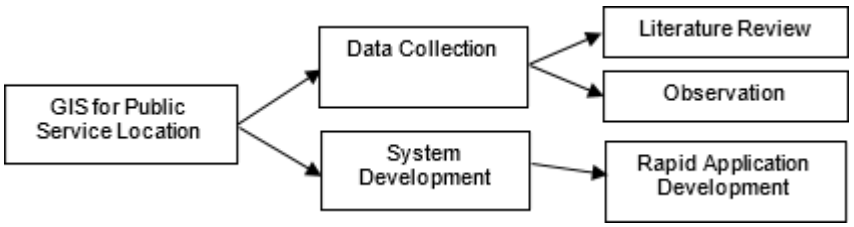

Figure 1. Conceptual framework.

2.1. Data collection

The process of collecting public service location data is carried out with two events, namely, data collection using field studies as primary data and literature studies as secondary data. Field studies in the form of observations to places or public service institutions to obtain actual data, in this case for data collection needs are limited to only public service locations in the province of West Java, Indonesia. Literature studies include data collection by studying various reference sources related to research.

2.2. System development

The approach to developing geographic information system software uses the 4 phases of the Rapid Application Development (RAD) model introduced by James Martin as in figure 2 [14].

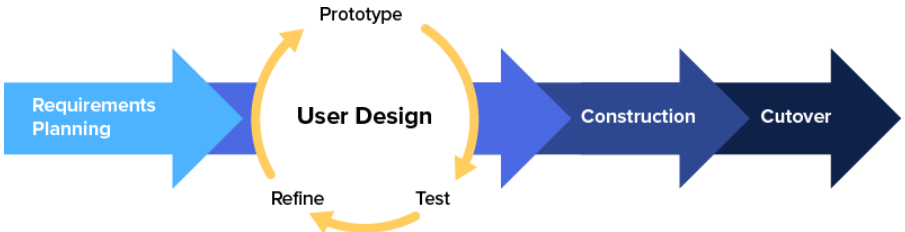

Figure 2. Rapid application development.

In the RAD method several stages must be passed such as analysis, design, construction, and final testing stages [15,16]. To simplify understanding, these steps can be divided into several processes included in all RAD models, namely business modeling, modeling data, process modeling, application generation,

testing and turnover [17]. If the needs are well understood, the process of developing software methods allows the development team to create a functional system that is intact in a short period (60-90 days).

3. Result and discussion

3.1. Requirements planning

The scope of this public service location mapping system emphasizes on the location of public services based on various categories of information and sites of primary and secondary public services [4]. The types include government institutions, law enforcement institutions such as police stations, health institutions such as hospitals and health centers, Educational institutions such as schools and universities, banking institutions, places of worship, and other public institutions in the province of West Java, Indonesia. From the public service category, there is a geo-map from an object of public service that will display information and directions for users to facilitate the path to the location based on the geolocation of users to public service locations.

3.1.1. Problem analysis. Along with the advancement of mobile devices technology, one of the information that is often needed by the public is informed about the place of public service. Then we need a system that can support the ease of getting information anywhere and anytime. To overcome the problem that what is required by the community is to make it easier to get information on public services and directions to that location, then the system designed is made based on Geographic Information System (GIS) and Android smartphone in the hope of helping the wider community to get information quickly.

3.1.2. Functional requirement. There are two types of users in the Geographic information system for mapping public service locations, namely administrators and users. The role of the Administrator is to manage data on the site of public service objects from data collected with a Web-based interface. The part of the User to find out / find the place of public service to be visited with an Android smartphone-based interface. The data presented is in the form of geo-maps, information on where public services are equipped with pictures, knowing the nearest public service place, displaying the route of travel from the user's location to the destination location, and adding data by the user with the login feature via social media.

3.1.3. Non-functional requirement.

- Showing categories of public service places;
- Geo-maps displays the location of the nearest public service when the user opens the application based on the user's Global Positioning System (GPS) position, by presenting information using the Application Programming Interface (API) map from Google Maps;
- Displays public service places in the form of location maps along with related information;
- Display the route of travel from the location of the user who first accessed the system to the destination location with GPS tracking;
- Conducting a search process for the place of public services to be visited;
- Allows the User to propose additional location data for public services which will be validated by the Administrator, by first logging in using a social media account;

3.2. User design

In this phase, the architecture of the application system needs for the solution to be approved include the components required by the system. User Data is the management of user data systems. Public Service Location Data is a data management place for public services. Access Right is the right of access to the system for each user, each user who will access the order can only be done according to the features possessed by each - each part. After determining the components of the system that will be

made the next activity to do system design includes, business modeling using flow map, modeling data using ER Diagrams, and modeling processes using Data Flow Diagrams.

3.3. Construction

In this phase, programming and application development work using IDE Android Studio tools, Adobe Dreamweaver, and Apache Web Server, while the programming languages are Hypertext Preprocessor (PHP), Java, and JavaScript, and data storage with MySQL databases.

3.3.1. Menu structure for administrators and user.

Table 1. Main menu structure for administrators and user.

Administrator	User
Login	Home
Data User	Public Service Category
Data Public Service Location	Search and Navigation
• Add Data	Share Location
• Delete Data	Login via Social Media
• Update Data	• Add Location
• Search Data	• Delete User Location
• Validation User Data	History
Help	Help

3.3.2. Table and attributes.

Table 2. List of table and attributes.

Table Names	Data Dictionary
User	id, name, username, password, active
Category	id. icon, name
Data Location	id, name, address, idcategory, dayopen, dayclose, opentime, closetime, telp1, telp2, owners, latitude, longitude, foto, active

3.3.3. Interface for administrator. Some web-based interface designs for administrators:

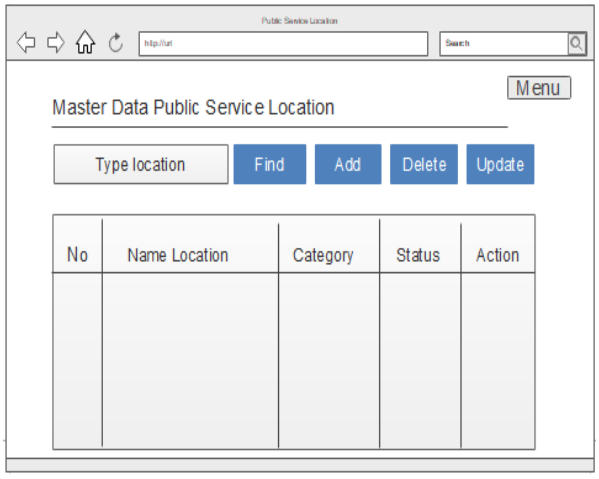

Figure 3. Master data for administrator.

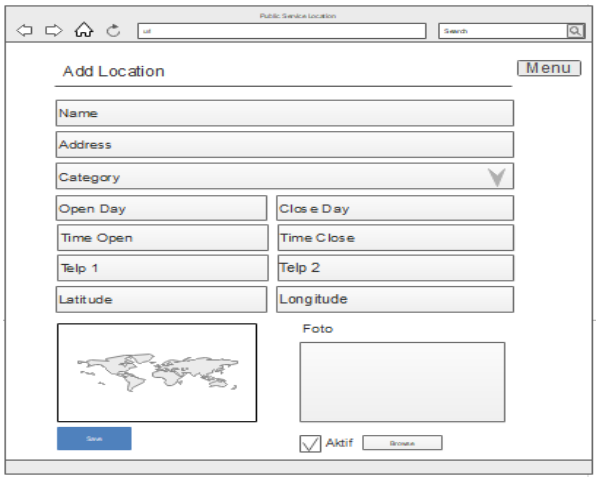

Figure 4. Add data public service location.

3.3.4. Application prototype. Some examples of application implementation for Users in Android smartphone:

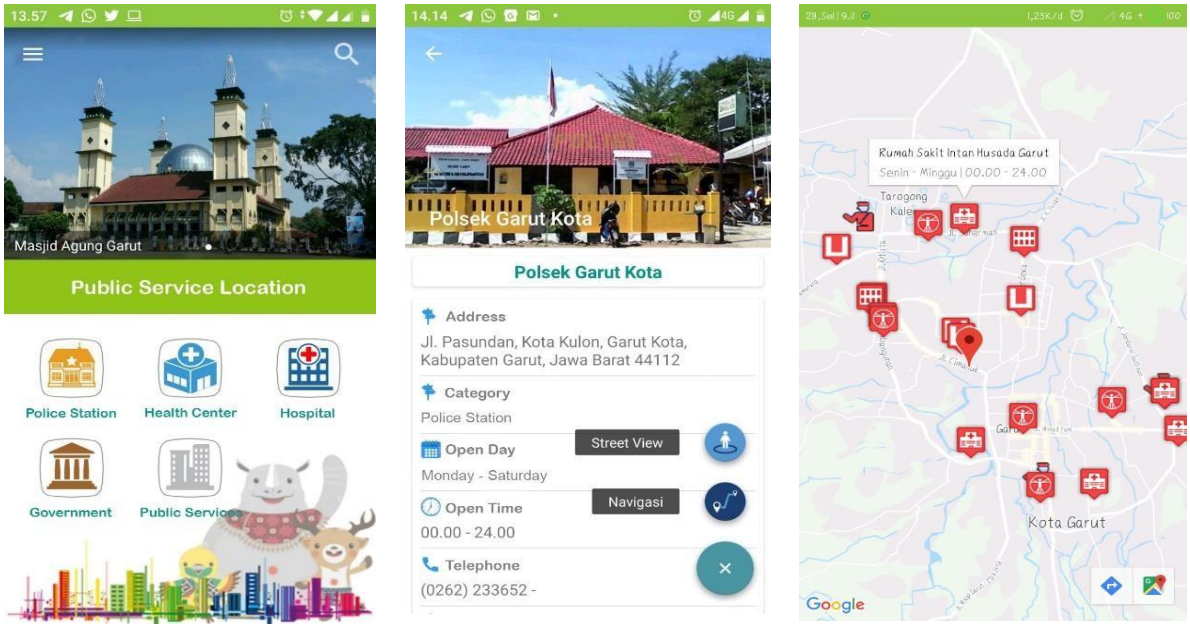

Figure 5. Application implementation for users in the android smartphone.

3.4. Cutover (evaluation and testing)

In this phase, the evaluation and testing are done first from the prototype application before the application can be used. Testing application functionality using the black-box testing method. Testing includes input, process, and output so that the app works as expected. For further system development with enhanced features, sufficient effort is needed in the development of software projects starting from the estimation of development costs, time and resources, one way to make an effort to estimate future software development projects is to use the UCP approach [18,19].

4. Conclusion

Based on the results of the discussion of the Geographic Information System based mapping system, public services can help people find information, contact, and visit public services nearby, because it has the closest location search feature based on GPS which makes it easier to use to show the way to the location is more accurate. Another feature is search based on a place name, category, address and geo-maps, and users can add new location data just by logging in using social media accounts. While based on the results of testing, the use of an Android platform-based application will further maximize the functionality from the application system mapping public services location.

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