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Design and Implementation Web Based Geographic Information System for Public Services in Bandar Lampung City - Indonesia

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Abstract-- **The work on this paper has point of view on development of public service geographic information system at Bandar Lampung City. The idea of this application deployment was driven to provide a better public services for the citizens. Currently, information of public service locations category which are needed by the citizens those are; lodging/housing information, health facilities, government office, service station, worship place, traditional market, modern market, banking, culinary, sports facilities, tourism, industry, police station, school/university place, tour and travel. The developed application enables the possibility to locate the public service information through web page easily. In this research, deployment of public services application based on Unified Modeling Language (UML) approach, including the use case model, activity diagram, and object diagram. The authors also explored usage of several non commercial applications under General Public License that is; apache2 web server, PHP5 programming language, MySQL5 for data base server, Google Maps API as base map of city visualization. A lot of public service information on Bandar Lampung city have been gathered, which are emerged the location on application including its picture, short video, and short description about the places. This application can be easily integrated with existing of city government web portal by using XML data transport technology, to improved a better public service for the citizens.**

Keywords—web based geographical information system; GIS; public services on bandar lampung city; UML

I. INTRODUCTION

Bandar Lampung is the capital and economic hub of Lampung province, Indonesia. The city's area is about 197.22 km², consist of 13 districts and total 98 sub-districts with 879,651 total populations on this city, census data 2010 [1].

The Government was striving for improving the quality of public services to the citizens. Department of Information and Communication (Kominfo) as one of the relevant units that responsible for development information technology in Bandar Lampung City focused on public aspirations absorption and public information dissemination [2]. The city government has an official website, can be accessed by url http://bandarlampungkota.go.id (maintained by Kominfo). Several public services information is presented on this website, but unfortunately the published information not too complete.

A small survey to some of citizen has been conducted by us to prove the issues. Based on this survey the respondents said that they feel difficult to identify public service information on this web portal. Almost many of them said that the most information they need i.e., health care location, auto service place, food and drink, lodging information, location for recreation, and educational place information, are not displayed on web. Based on the current issue, we try to find a solution by developing an application for public service information. In this work, the Web GIS, which is developed based on Unified Modeling Language (UML) approach is presented including the case model, activity diagram, and object diagram.

We also explored for open source software under General Public License such: Apache2 web server daemon, PHP5 programming language tools, MySQL5 as data base server, and Google Maps-API as base map of city visualization. Authentication method was also already deployed into the system as security pass for public service place management. A lot of public service information on Bandar Lampung City have been gathered and emerged the location on application including its picture and short video about place description.

II. RELATED WORKS

Jiangping et al on their works paper [3], presented the research on developing of surveillance application for Nile virus at Canada Country based on real time monitoring using Open GIS application. On the work in [4], they illustrate some reviews of the literature on the use of GIS based measures for healthcare area. Bernardi in their paper work [5] provided new IT concept that impact to institutional management paradigm. They made an integration of new IT enabling model services in public sector area for developing countries especially case study on Africa country. Zongyoa et al in their works [6] was developed their decision support system(DSS) integrate with some knowledge from the experts, GIS analysis model is used to help the agricultural industry, particularly the field of agronomy to support effective decision making and appropriate for each production in agricultural areas with support by a good knowledge.

In addition, Lionel et al on their works described a technique to increase interaction testing by accounting for state based behavior as data flow information [7]. State machine diagrams and UML sequence are combined into control-flow graph then generate integration test cases. In order to assess their technique, they developed prototype and applied it on small case study. The work in [8] was developed web based mapping tool (EYEMAP) for health decision support systems. Several cases used for supporting the reliability of findings. The aim is to identify the obstacles on map production, and create a web applications that suitable for data analysts or materials for their managers. Their study was guide by the Ottawa Model Research Use frameworks.

Works on paper [9] [10] already used cloud computing technology for geospatial information system. The works result in [10] described that cloud computing technology was suggested as a suitable method that may be used to reduce the operational costs components and computing complexity by running an application that can be run through the Internet. This study discusses the proposed of GIS models of cloud computing for improving the emergency management. This application has been tested, already implemented and run successfully for predicting earthquake activity and emergency management platform base on Microsoft Azure applications cloud computing technology. They made a performance measurement of applications on different platforms, several conducted tests on cloud technology environment and others was running on localhost environment.

The works in [11] [12] describe Model Driven Architecture (MDA) for geospatial data modeling. Additionally in [13] the author presented the designing plan of Service Oriented Architecture for GIS applications for data spatial integration (SOA SDI), its allowing applications on the client side to pull in some data, and presenting data spatial from various sources of data spatial provider. Architecture proposed in this study logically there are four components layers; namely (1) a layer of some service data providers, (2) data integration layer, (3) the layer of service interface backend, (4) graphical user interface front end for presenting spatial data.

The Implementation of four layer SOA SDI frameworks, made deployment of GIS applications be able to quickly built, that proving SOA SDI potential to reduce input of software deployment and shorten period of development.

On the work in [14] Abdullahi designed an applications for public health services in order to supporting a wide range of various health data collection, they use open source software, web server is ApacheDaemon, My SQL and ARC GIS version 9.2. The system is facilitated with a security module which built as an authentication to access the database.

GIS application for health service already implemented on works [15] [16] [17] [18]. GIS application for public services was also presented on paper [19] [20] [21] [22] [23] [24] [25]. Especially the works on paper [22] in their study that have been conducted, they using GIS technique to assess the accessibility of public transport services. The analysis technique they developed was able to identify transportation by zone, isochronal, and raster based assessment of accessibility in transport networks, they implementing on the 9 different routes metro, as well as the train line at Instambul Turkey which serves nearly 400 million movements per year successfully analyzed as a case study on their research. The result of research in paper [20] discusses the deployment methods of bus transportation management based on GIS technology emerge with Global Positioning System technology. Their system can store a variety of any information about the daily operations on public transportation. Their research paper presents how to perform common data tracking of the vehicles movement to be used for controlling the movement of public transport and visualize the routes condition that will provide as a vehicle inventory data.

Muhammad A et al on their research in [26] they used principle of object oriented software engineering. The life cycle of software deployment used to make some of requirements analysis, system design, and web application deployment collaborative public participation geographic information systems based. They also used unified modeling language and web based engineering framework.

The results of research on paper [27] described that they apply the framework especially on modeling constraints comprising; that is; 1). The process of clarification and classification constraints, 2). Formal process description used unified modeling language and object constraint language, 3). Execution of characteristic. This framework is applied and introduced as Salix 2, geo virtual reality modeling system landscape.

The result on works [28] explained that implementing IT could give great opportunities in success story of modern governance, at the other side it's also considerable concern in terms of administrative power and the abuse of the power. The results of their research presents the basic concepts of the philosophy of the role and usage of information technology, and discusses the importance of implementing GIS in the public service sector. IT systems that built must be based on democratic values and has a high value institutional integrity as a public service office. Works on paper [29] [30] [31] [32] [33]

described the used of several open source application for developing applications.

III. SYSTEM REQUIREMENT

A. User Analysis

To determining the characteristics of user needs we made a small survey to random respondents of Bandar Lampung citizens, mostly they had difficulty in finding information about public services in Bandar Lampung city. We identified several of important categories that should be provided on public service application such as lodging, health facilities, government office, service station, worship place. They also need searching feature to find the public services.

B. Task Analysis

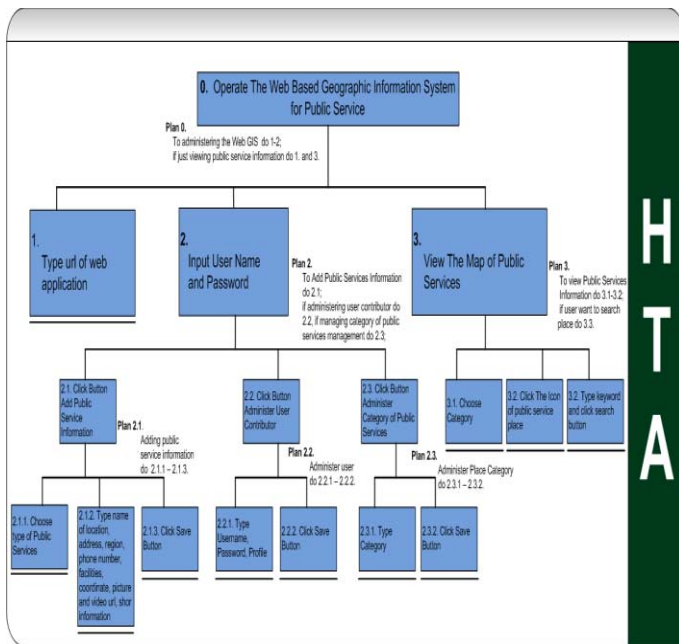Task analysis was also used to describing and analyzing how people do their jobs, Fig.1 is diagram of task analysis.

Fig.1 Hierarchical Task Analysis (HTA) Diagram

IV. UML MODEL DESIGN

A. Behavior Diagrams

The following diagram was used in designing process of system;

- *UseCase Diagram*

  Use case model is used to describe the requirements of a system to be built. Typically use case diagram shows the interaction between the system application and the external entities that affect to overall system. External entities are represented as an actor. Actors may represent role as human, or as hardware or comes from other systems. The following use case of the system to be built:
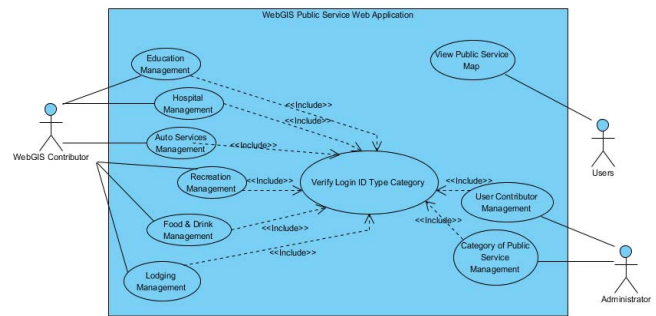

Fig.2 Use Case Diagram of Web-GIS Public Service

Fig.2 shows the design of use case, there were 3 actors involved directly on the system include; Web GIS Contributor, Administrator, and ordinary users. Administrator has full authority to manage the overall system, admin can accessed all control management such as lodging management, food and drink, recreation, auto services, hospital, education, can manage user contributor (add, edit, delete), can manage the category of public services. While the Web GIS Contributor only able to perform management of lodging, food and drink, recreation, auto service, hospital, education, etc. While ordinary Users can only view public services maps.

- *Activity Diagram*

  UML activity diagram are used to describe the behavior of the control flow or object flow that may occur in the system. All activities are coordinated by a few models that can be started because other action has been completed executed, objects and data become available, or some other external triggers that cause a flow occurs. Fig.3 shown the diagram, the activity began with open web application, to view the map of Public Service information, users doesn't need authentication, they can view directly information of public services including map position of place, picture, and short video about public service. Authentication will be given for Administrator or web GIS Contributor. Administrator has full authority to manage the system, if users successes login with Administrator account, system will show all admin modules, such as public service management, user contributor management, category of public services. While web GIS contributor can only manage for lodging, food and drink, recreation, auto services, hospital, and education. After performing each activity access closed with logout and the activity is completed.
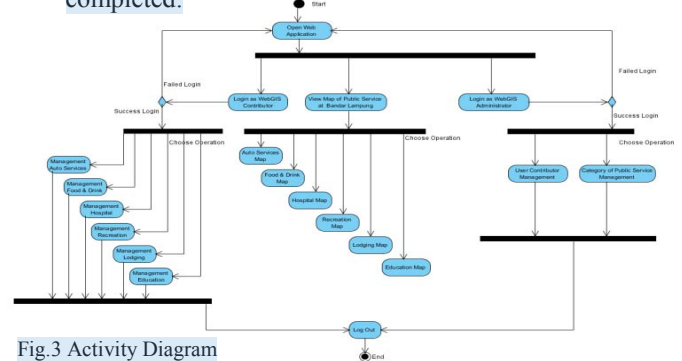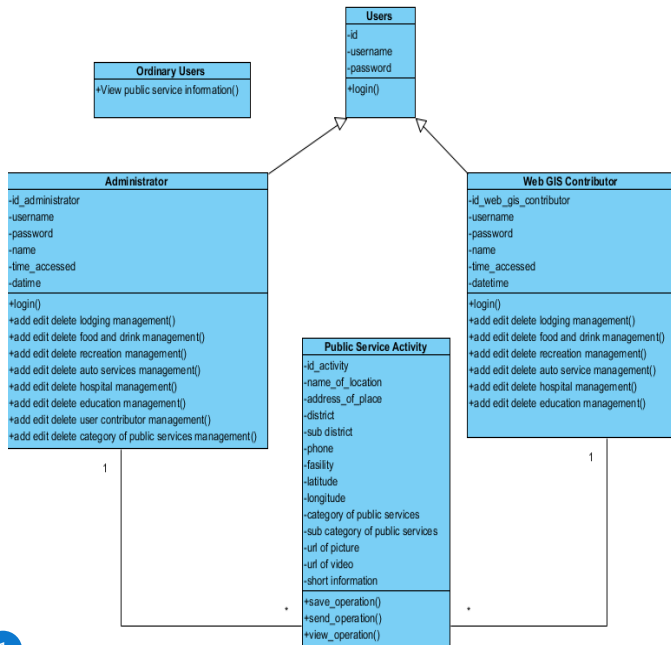

Fig.3 Activity Diagram

B. Structure Diagram

Structure diagram is one of the UML diagram depicting the internal structure of several classifier, including its interaction points with various parts of the system to be built. The following diagram is used in the process of designing the system.

- Object Diagram

Fig.4 Object Diagram

Fig.4 shown the object diagram, from this diagram drawn relation between each object, administrator and web gis contributor drawn as a specific object, public service activity object related to administrator and web gis contributor.

V. WEB GIS APPLICATION

Fig.5 represents the screen capture of web GIS application, both pictures displaying all public service placed on Bandar Lampung City, there were several icon for public service representation on web. Ordinary users can access the application through this url http://webgis.unila.ac.id, user will not requested any username and password to view the information. Users can easily click the icon on map to find out what kind of public service information they want. Users can also view the picture of each place, this feature very helpful especially for users who want compare each of public service especially on hospital or education services. If users not pleased for display picture of each place, they are able to play a short video of each place (the video hosted on YouTube) embed on web GIS application.

Fig.6 show that webgis application also provided by some features, such as hide/show categories, search specific desired location by typing keyword location, zoom in/out map, detail of public services information, and displaying location group by specific category. There were total 1,251 places mark already submitted to system, consist of several categories. Educational information place mark was the highest number that recorded by the contributors than other categories.
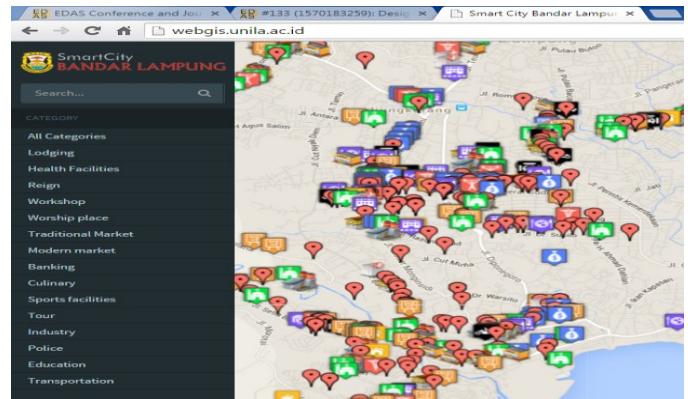

Fig.5 Web GIS application for ordinary users

In this study already identified some locations of public services in several districts at Bandar Lampung City, the districts were identified namely was Bumi Waras, Enggal, Kedamaian, Kedaton, Kemiling, Labuhan Ratu, Langkapura, Panjang, Rajabasa, Sukabumi, Sukarame, Tanjung Karang Barat, Tanjung Karang Pusat, Tanjung Karang Timur, Tanjung Seneng, Teluk Betung Barat, Teluk Betung Selatan, Teluk Betung Timur, Teluk Betung Utara, Way Halim. From total 20 sub-district already survey by researcher, we classifies there were 15 major public services categories that is lodging, health facility, government facilities, machine shop place, worship place, traditional market, modern market, banking, culinary, sports facilities, tour, industry, police, education, transportation, there were total 1,251 places have been gathered, and store on webgis application that spread out on districts. Lodging (39 locations or 3:11 %), Health facility (133 locations or 10.63 %), Government facilities (121 locations or 9.67 %), machine shop place (60 locations or 4.79 %), Worship place (128 locations or 10.23%), Traditional market (16 locations or 1.27 %), Modern market (133 locations or 10.63 %), Banking (63 locations or 5.63 %), Culinary (144 locations or 11.51 %), Sports facilities (23 locations or 1.83 %), Tour and Travel (11 locations or 0.87 %), Industry (81 locations or 6.47 %), Police (23 locations or 1.83 %), Education (261 locations or 20.86 %), Transportation (16 locations or 1.27 %).
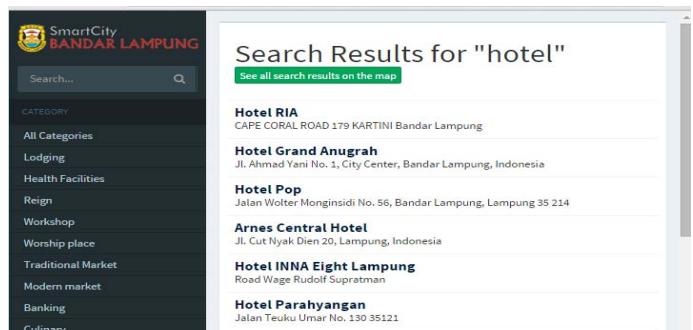

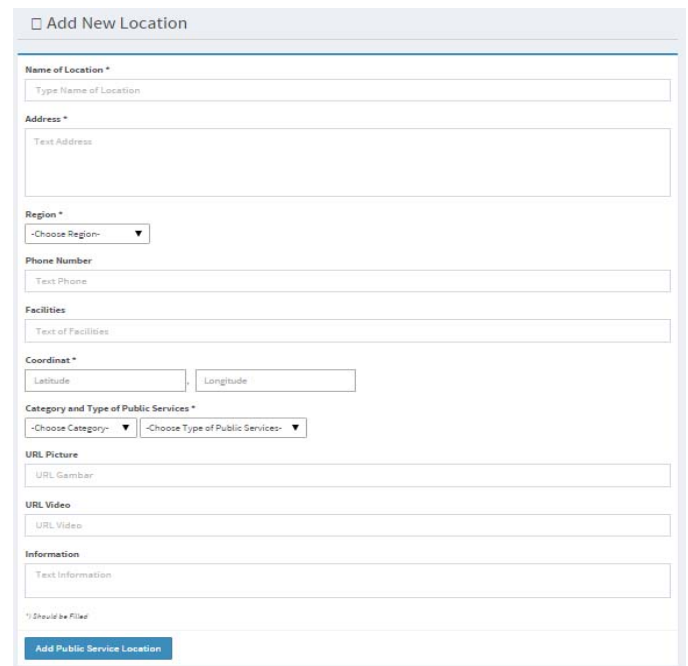Fig.6 Feature showing categories and search

Fig. 7 Login to Web GIS application

Fig. 7 show the login form that designed for administrator and web GIS contributor only, before they can get in to their dashboard they should type their username and password correctly. Fig. 8 show the dashboard for administrator, this user type have full controlled of this application, there were 7 menus shown on dashboard, add location, displaying the list of places and can edited the place mark, category of public services, district, users, setting, dashboard. Administrator can directly add, delete, and edit public place that entry by contributor or by him self. They can also add new district information if need to. Users management was also controlled by administrator, admin can do action of adding/edit/remove any of contributor users.

Fig.8 Administrator Dashboard

Fig. 9 Form entry of public service place

Fig. 9 shown the form of adding public service location, administrator or web GIS contributor should fill out 12 fields for new place entry, that is name of place, address of place, choose district, phone (if the place has phone number), facility of place, latitude information, longitude information, choose main category (lodging, food and drink, recreation, auto services, hospital, education), choose sub category, url of place picture, url of place video (hosted on YouTube), any additional information about the public service. The field with red textbox area should be filled, other just optionally to entry.

XML technology was implemented on this system for simplifies data transport between application and other system that needed those public service data. XML data stored in plain text format. This will make the data more easy to expand or upgrade within new applications, or new browsers, without lose any data. Lampung government application system can be easily using this data because the data has been defined as a well known format as a formal XML, data structure shown bellow.

```
<markers>
    <marker nama_lokasi = " Perum Sukamaju Indah " alamat =
    "Jl. Laks. RE Martadinata" id_kecamatan = "19" telp =
    "081279198884" fasilitas = "" latitude = "-5.462191" longitude
    = "105.249535" id_kategori = "1" id_jenis = "1" gambar =
    "sdy.jpg" video = "bUPt6Bp-PWA" info = "" icon = "1.png"/>
    <marker nama_lokasi = "Perumahan Puri Gading" alamat =
    "Jl. Puri Gading" id_kecamatan = "19" telp = "" fasilitas = ""
    latitude = "-5.472818" longitude = "105.245499" id_kategori =
    "1" id_jenis = "1" gambar = "" video = "NJ8fJq40DIQ" info =
    "" icon = "1.png"/>
</markers>
```
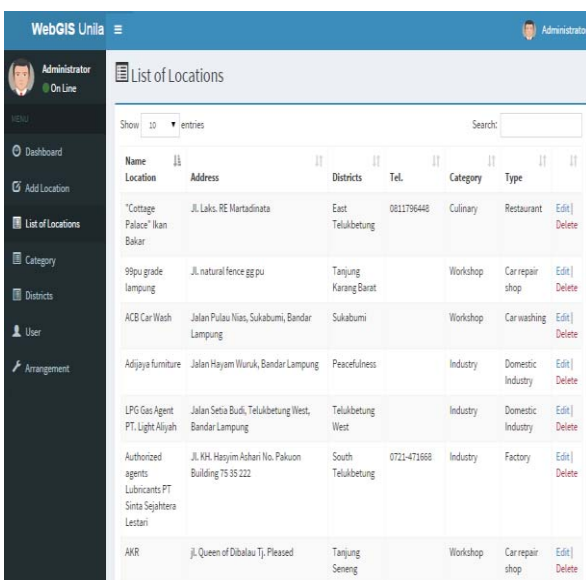
VI. CONCLUSION

In this paper, the Web-Based Geographic Information System for Public Services at Bandar Lampung City was developed. The system design is proposed on UML approach. The system has been in operation and can be accessed using this url http://webgis.unila.ac.id, several open source application such as Apache, PHP, MySQL, can provide as good as well for this application. The application can be easily integrated with existing of Bandar Lampung Government web portal by implementing XML technology for data exchange to improved the public service for all citizens.

VII. FUTURE WORKS

For future work, we consider enriching the public service information on Bandar Lampung city, and it will be better if the application can integrated with social media (facebook or twitter) to invite public participation for adding the new data.

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