Geographic Information Systems for web-based maternity centers

A Mulyani1*, D S Maylawati2, D Kurniadi1 and R D Putri1

1 Department of Informatics, Sekolah Tinggi Teknologi Garut, Jalan Mayor Syamsu 1, Garut, Indonesia
2 Department of Informatics, Universitas Islam Negeri Sunan Gunung Djati, Bandung, Indonesia

*asrimulyani@sttgarut.ac.id

Abstract. One of the benefits of the geographic information system (GIS) is that it is a tool for capturing, storing, and displaying data related to the approximate position of the earth. The delivery place is one of the critical areas that considered urgent to deal with the delivery of pregnant women. With this information system, it expected that the public could quickly obtain information on the distribution of the nearest birthplaces, profiles of medical personnel such as doctors, midwives, and nurses as well as available facilities. The methodology used in this study is the Rational Unified Process, with stages: inception, elaboration, construction, and transition. The results of this study are web-based GIS applications to search for distribution of maternity places to facilitate the community in finding anywhere the distribution of midwives, their location, and facilities in the midwife’s area.

1. Introduction

One of the benefits of geographic information systems is as a tool to capture, store and display data related to the approximate position of the earth [1,2]. Geographic Information Systems defined as a database computer system with special capabilities for spatially referenced data or geographical coordinates along with a collection of operations that manage the data [3,4].

The place of birth is one of the health service places that are considered important for pregnant women through the delivery process. The problem that is happening right now is that people are having trouble finding information about the distribution of maternity places, which equipped with information about the place profile and available service facilities. To overcome this problem, we need an application that can facilitate the community in getting preliminary information about the place of birth before they come directly to the area. For starters, this application based on a web site for the distribution of maternity centers in Garut Regency by taking a sample of midwife medical personnel, this application also expected to provide actual information for people in need. It planned to provide practical information for the surrounding community in need. The efforts needed to build a geographic information system application for this birthplace, namely, must pay attention to the estimated costs, time, resources, methods, and implementation targets [5–7].

The aims of this article are to design an application of a geographical place to give birth information that can make it easier for the community to find a place of birth in the Garut district. Also, the public can find out other information such as profiles of doctors, midwives, and nurses as well as available
facilities. The system design methodology uses the Rational Unified Process (RUP) [8,9]. The results of this research work are the application of geographic information systems for web-based birthplace locations. The contribution of the research expected that the app made can help the community in finding the distribution of midwives in Garut Regency area.

2. Methodology

2.1. System design methodology
The system design uses Rational Unified Process (RUP) methodology, which is a software development approach that carried out repeatedly (iteratively), focuses on architecture-centric structures, and is directed based on use case (use case is driven) [9]. The life cycle of the RUP is presented in figure 1.

![Figure 1. The life cycle of rational unified process.](image)

RUP is a software engineering process with a well-defined and well-structured method. The Rational Unified Process provides an excellent structural definition for the life of a software project. Rational Unified Process has four-step that can be done iteratively, namely inception, elaboration, construction, and transition [10,11].

2.2. Activity workflow

![Figure 2. Activity workflow.](image)

To complete this work an activity workflow is created based on the RUP method as shown in Figure 2 with the following steps: literature review, identify business processes, actor specifications, and determine the actor are activities of inception. Elaboration contains a designing diagram of use case, activity, sequence, and class diagrams. Application design and implementation is the activity of construction, and testing is the activity of the transition [12].
3. Results and discussion

3.1. Result

3.1.1. Inception. This phase of inception is a stage that carried out to understand what will be built, steps carried out include:

- A literature study is a review process from various publication sources relating to the topic and will be used as a reference for writing articles.
- Identification of business processes produces a flow of business processes that are running in the search for a birthplace, while for business processes that are built will be made a new system by proposing to develop a computerized geographic information system distribution of birthplaces by using a computer platform.
- Determine the system specifications to produce the requirements in the design of geographic information systems distribution web-based delivery place, namely: display requirements, system requirements, development requirements and system boundaries.
- Determining actors produces identification of target users who will be involved in the system, namely admin, midwife, and user or community.

3.1.2. Elaboration. At the stage of elaboration resulted in a use case diagram that visualize the interaction between actors with the system [13], activity diagram to visualize the activity of the existing system software, sequence diagrams to define business processes and systems to interact with the actors, and class diagrams to help in the design interface. Use case diagram can be visualized in figure 3:

![Use case diagram of GIS for maternity centers](image)

Figure 3. Use case of GIS for maternity centers.

Furthermore, activity diagrams created include midwife activity diagrams, including activity list, log in, and logout. The user activity diagram provides access to the main menu, selecting the location of the midwife, and viewing details of the midwife's profile. Admin activity diagrams include login and verification activities. The system design made consists of a menu structure that is the user menu structure and the midwife menu structure. In contrast, the layout design consists of the midwife list layout, midwife login, midwife profile input, user main menu access layout, and detailed layout of the midwife profile. For the menu structure of users and midwives can be seen in Figure 4.
3.1.3. Construction. Construction produces an application design as an implementation of a programming language following the configuration specified at the elaboration stage. The result of its implementation is an application that is ready to follow the system testing process. Examples of application appearances are in Figure 5 below.

3.1.4. Transition. The fourth stage is the transition; this stage is a system trial using the black-box testing method, which aims to test the system with analysis or previous steps. The scenes that are tested start from inception, elaboration, to construction with functional specifications without testing the design and program code. This stage produces a trial in accordance with the analysis and needs, as well as all features in the application run well.

3.2. Discussion
The application of geographic information systems for mapping web-based maternity places has a vital role in helping the community, especially for pregnant women who will give birth in the search for midwives, delivery locations, and facilities. Some features of the application are made, first the midwife registration feature, with this registration feature the midwife usually registers herself into the system; next features a complete profile of the midwife's identity and expertise; the three features for loading...
maternity data complete with geographical coordinates information; the four features of any facility available at the midwife's place. While the feature for users can search, view, and choose the location of the midwife to go to, along with the details of the midwife's profile and facilities in the form of photographs, and directions to that location. Whereas for future application development, one of them can be by adding an automatic classification feature regarding the mapping of maternity places based on position and service facilities, one of which is how to apply the classification algorithm [14,15].

4. Conclusion
Based on the result and discussion, the findings of this study resulted in a geographic information system for the mapping of web-based maternity centers and midwives. With this application, it is expected to be able to convey information about maternity centers, midwives, locations, and facilities available to the community. As for suggestions for future work development, one can add automatic classification features regarding the mapping of maternity places based on position and service facilities by applying classification algorithms.

References
[1] Van Kreveld M 2017 Geographic information systems Handbook of Discrete and Computational Geometry, Third Edition (US: CRC Press)
[2] Aulawi H, Mulyani A, Kurniadi D and Septiana Y 2020 Technology Acceptance Model for Online Transportation Int. J. Adv. Trends Comput. Sci. Eng. 9 31–5
[3] Sholarin E A and Awange J L 2015 Geographical information system (GIS) Environmental Science and Engineering (Subseries: Environmental Science) (Cham.: Springer) pp 239-248
[4] Kurniadi D, Mulyani A, Septiana Y and Akbar G G 2019 Geographic information system for mapping public service location J. Phys. Conf. Ser. 1402(2) 022073
[5] Mulyani A, Septiana Y, Tresnawati D and Setiawan R 2019 Design of culinary information system based on android using multimedia development life cycle J. Phys. Conf. Ser. 1402(2) 022074
[6] Kurniadi D, Abdurachman E, Warnars H L H S and Suparta W 2019 A proposed framework in an intelligent recommender system for the college student J. Phys. Conf. Ser. 1402(2) 066100
[7] Septiana Y, Mulyani A, Kurniadi D and Arifin D M 2020 Information Systems Strategic Planning For Healthcare Organizations Using Ward And Peppard Model Int. J. Sci. Technol. Res. 9 4718–21
[8] Mohd H, Robie M A M, Baharom F, Darus N M, Saip M A and Yasin A 2016 Adapting Rational Unified Process (RUP) approach in designing a secure e-Tendering model AIP Conference Proceedings 1761(1) 020066
[9] Coleman K, Marshall E and Thomas C 2019 A Methodology for the Visualization of Rational Unified Process Syst. Softw. Eng. Publ. 1(1)
[10] Kroll P and Kruchten P 2003 The Rational Unified Process Made Easy A Practitioner's Guide to the RUP; A Practitioner's Guide to the RUP (US: Addison-Wesley Professional)
[11] Cosmas N I, Christiana A F, Jeremiah O O and Ikechukwu A C 2018 Transitions in System Analysis and Design Methodology Am. J. Inf. Sci. Technol 2 50–6
[12] Zielczynski P 2007 Requirements management using ibm®rational®requisitepro® (NY: IBM press)
[13] Kurniadi D, Mulyani A, Septiana Y and Aulawi H 2018 Estimated software measurement base on use case for online admission system IOP Conf. Ser. Mater. Sci. Eng. 434 012062
[14] Baswardono W, Kurniadi D, Mulyani A and Arifin D M 2019 Comparative analysis of decision tree algorithms: Random forest and C4.5 for airlines customer satisfaction classification J. Phys. Conf. Ser. 1402 066055
[15] Hariz H A, Dönmez C Ç and Sennaroglu B 2017 Siting of a central healthcare waste incinerator using GIS-based Multi-Criteria Decision Analysis J. Clean. Prod. 166 1031–42