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The Geographic Information System of The Distribution of Larva Free Rates in Kediri City Area

Ashafidz Fauzan Dianta[1], Toga Aldila Cinderatama[2*], Fery Sofian Efendi[3]

[1,2,3] *PSDKU Polinema Kota Kediri, Jl. Lingkar Maskumambang, Mojoroto, Kediri, Indonesia .*
**Corresponding author e-mail : toga.aldila@polinema.ac.id*

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Abstract

The larvae absence rates are the proportion of houses with negative larvae with respect to the number of inspected houses. The lower the mosquito larvae absence rates, the greater the possibility of dengue transmission at the research site, since the dengue transmission radius is 100 meters from the patient's location. Kediri City Government now does not have any Geographic Information System to represent mosquito larvae free rates. Since a lack of representation of the larvae free rate distribution makes the monitoring process for larva free rates per region less effective and efficient. Therefore, a geographic information system must describe the distribution of Mosquito larva absence rate in the Kediri City area. The design and development of this geographical information system are carried out using two methods: the data collection method by conducting interviews with the staff in the Kediri City Health Office, observing and looking for references related to research.

The Geographical Information System for the Distribution of Larva Free Rates in Kediri City was successfully designed and built, enabling the distribution of larva free rates in the form of markers and polygon on a map. The Geographical Information System for the Distribution of Larva Free Numbers in Kediri Regency was built use PHP, HTML, CSS, JavaScript, MySQL, and the laravel framework.

The existence of a Geographical Information System for the Distribution of Larva Free Rates helps the Kediri District Health Office recapitulate data and monitor the risk of the distribution of larva numbers in the Kediri Regency area..

Keywords: *Geographic Information System, Kediri Regency, Larvae Free Numbers*

1. Introduction

The development of science and technology, which is marked by advances in communication and information technology, puts a nation in a position to which the nation has advanced based on how far the nation has mastered the two fields (H. D. Utomo and E. Mulyanto, 2010). Geographical information systems also include technological advances in collecting, examining, integrating, and analyzing information relating to the earth's surface. So that with the construction of a geographic information system, solving problems related to the information obtained will be more comfortable. Dengue hemorrhagic fever is caused by the dengue virus and is transmitted through the bite of aedes aegypty mosquito. Dengue hemorrhagic fever is still a significant problem because it can cause outbreaks at certain times that are difficult to predict. Dengue hemorrhagic fever has been classified as an epidemic disease in the infectious disease outbreak law no. 4 of 1984 (E. Nuryanti, 2013). Larva Free Rate (ABJ) is the proportion of negative larva houses with the number of inspected houses. The lower the ABJ shows, the greater the possibility of dengue transmission in the survey location, considering that the DHF transmission radius is 100 meters from the patient's location. According to the Minimum Service Standards (SPM), the minimum ABJ value to limit the spread of DHF is 95% (DKK Semarang, 2007). In the middle of January, there were 265 victims, both suspect, and positive dengue fever. Of that number, there were 9 fatalities due to diseases caused by the Aedes aegypti mosquito. In fact, if compared to December 2018, according to data from the Kediri Health Office, the number of dengue patients was only around 205 sufferers. Hence the half-month of January this is considered relatively high. From the same data

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source, the number of DHF sufferers for January 2018 was 151 patients and in January 2017 there were 115 sufferers (Hakim, 2019). The Geographical Information System for the Distribution of Larvae (Larva Free Numbers) is a system that can facilitate the Kediri district health office in displaying the distribution of larva-free numbers in Kediri Regency. A map in this geographic information system will help the health office monitor the risk of disease caused by mosquitoes in the area concerned.

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1.1 Research Objective

The goal of this research is to be able to design and build a Geographical Information System for the Distribution of Larva Free Numbers that can help the health office to draw data on the distribution of larva free numbers in the Kediri Regency area in the form of a map.

2. Literature Study

2.1 Mosquitos Larvae

In Indonesia, dengue fever was first suspected in Surabaya in 1968. In Jakarta, the first case was reported in 1969. Then, successive cases of dengue were reported in Bandung and Yogyakarta in 1972. First, on the island of Java, in 1972 in West Sumatra and Lampung, followed by Riau, North Sulawesi, and Bali in 1974, disease outbreaks were reported in South Kalimantan and West Nusa Tenggara. In 1994, DHF had spread to all provinces in Indonesia. Currently, dengue fever has become endemic in many big cities, even since 1975, the disease has reached rural areas (Hardiono. et al, 2016). The Aedes aegypti mosquito lives and reproduces in clean water reservoirs that are not directly related to the soil, such as baths/toilets, bird drinks, reservoir water, water jars, or barrels, cans, tires, and others. Since it was first discovered until now, dengue fever is still a public health problem which tends to increase the number of sufferers and the wider spread (T. E. Sukowinarsih and W. H. Cahyati, 2011)

2.2 Larvae Free Rates

Larva Free Rate (LFR) is the proportion of negative larva houses with the number of inspected houses. The lower the ABJ shows, the greater the possibility of dengue transmission in the survey location, considering that the dengue transmission radius is 100 meters from the patient's location. According to the Minimum Service Standards (SPM), the minimum ABJ value to limit the spread of DHF is 95% (Hardiono. et al, 2016). The larva survey shows data on the number of houses inspected, inspected water reservoirs, positive larvae water reservoirs, and negative larvae water reservoirs. The data used to determine the House Index (HI), Container Index (CI), and Larva Free Rate (ABJ). The House Index is the proportion of the number of positive houses with the number of houses inspected. The Container Index is the proportion of the number of positive water containers larvae to the number of containers examined (Depkes RI, 1996). Table 2.1 is the data from the larva-free rates survey, which shows the percentage of the number of ABJ in each month and each house.

Table 2.1 Example of larva-free rates survey result

Home	Bulan			
	July	August	September	LFR
Home 1		Larva Exist	Larva Exist	0%
Home 2	Larve Free	Larva Exist		50%
Home 3		Larve Free	Larve Free	100%
Home 4		Larve Free	Larve Free	100%
Home 5	Larva Exist	Larve Free		50%
LFR	50%	60%	67%	

To calculate the percentage of Larva Free Numbers can be calculated using the formula:

$$\text{Angka Bebas Jentik} : \frac{\text{Jumlah rumah yang ditemukan jentik}}{\text{Jumlah Rumah yang diperiksa}} \times 100\%$$

2.3 Sistem Koordinat

Coordinates are geometric magnitude expressions that specify a defined reference position. The reference position can be determined by assumptions or determined by a mathematical agreement that is universally recognized and standard. If the reference point's determination is assumed, the coordinate system is local or called local coordinates, and if it is determined as a mathematical agreement, the coordinates are called coordinates with a system of mathematical basis agreement.

To describe objects or features of the earth's surface on a computer screen, the researcher conducts a depiction system representing the earth's surface's actual state, which the researcher calls a projection. Researchers describe projections in a cartesian coordinate system, which is generally known in X and Y units. The projections that are often used in GIS are long-latitude projections (A. Prihandito,1988).

3. Research Methods

3.1 System Development Method

The Geographical Information System for the Distribution of Larva Free Numbers in Kediri Regency uses the waterfall system development method. Waterfall Model suggests a systematic and sequential approach to software development, starting from the specification of customer requirements and planning, modeling, construction, and maintenance (Pressman, 2010). An overview of the waterfall method, according to Pressman can be seen as in Figure 3.1.

Figure 3.1 Waterfall method according to Pressman

Information:

A. System / Information Engineering and Modeling

Starting with looking for the needs of the entire system that will be applied in software. Considering the software must be able to interact with other

elements. This geographic information system requires hardware, databases.

B. Analysis

In this step is an analysis of system requirements. Collecting data at this stage can be carried out by conducting a study, interview or literature study. An analysis system person will extract as much information as possible from the user so that a computer system can be created to perform the tasks that the user wants. At this stage, the authors in data collection conducted interviews with staff at the Kediri City Health Office to find out the system requirements required by the department, made observations to determine the running of the system that was taking place, and used literary studies in gathering information needed by the system through journals, and the internet as a reference.

C. Design System (Design)

The design process will translate the requirements into a software design that can be estimated before coding is started. This process focuses on: data structures, software architecture, interface representations, and procedural details (algorithms). This stage will produce a document called a software requirement. This document will be used by programmers to carry out system creation activities. The author has design use cases, activity diagrams, relationships between tables, system architecture, and system interfaces.

D. Coding & Testing (writing program / implemention syncodes)

Coding is the translation of designs in a language that can be recognized by computers—performed by the programmer who will translate the user's transactions. This stage is the real stage of working on a system. At this stage, the author will do the coding of the system design using sublime software that runs on the browser.

E. Implementation / Program Testing (Integration & Testing)

This stage can be said to be final in making a system. After analyzing, designing, and coding, the user will use the finished system. The goal of testing is to find errors in the system and then fix them. After the coding stage in working on this geographic system is complete, the author will test with the user to determine the deficiencies or errors of the geographic information system.

F. Maintenance (Operation & Maintenance)

Software that is difficult to deliver to users will change. Such changes can be due to errors because the software has to adapt to the environment (new peripherals or operating systems), or because the customer needs functional development. At this stage, if in testing the geographic information system of the distribution of larva free rates in the Kediri district, there are deficiencies or errors found by the user, then the author will correct these deficiencies or errors.

3.2 Use Case Diagram

Figure 3.2 is a use case diagram of the Geographic Information System for the Distribution of Larva Free rates in Kediri City area.

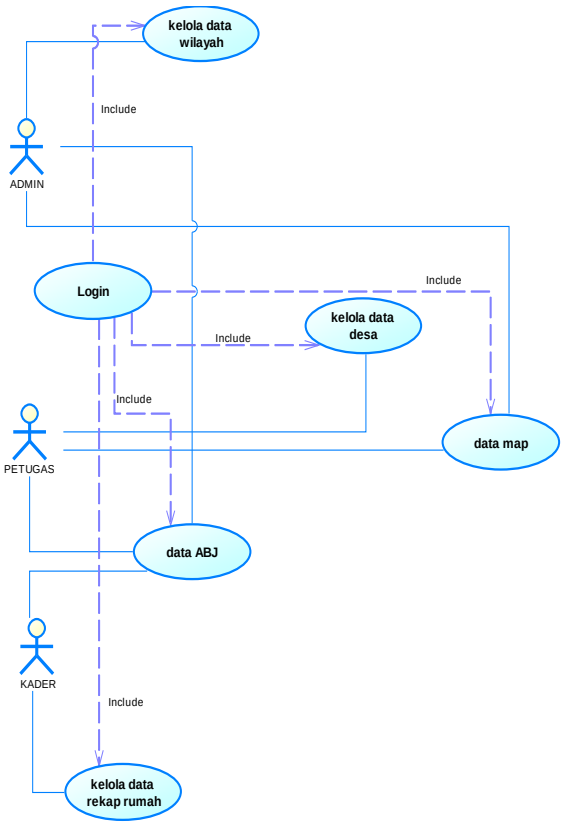

Figure 3.2 Use case diagram

In this Use Case there are 3 actors. Each actor has access rights and will discuss in Table 3.1.

Tabel 3.1 Actor Definition

Num	Actor	Deskripsi
1.	Admin	Admin is a person who has the authority to manage all data in the larva free number system, including input, update, and deletion of data. Admin can see the report of the larva free rates based on the survey data
2.	Officer of Puskesmas	An officer is a person who has the authority to manage village data and free larva rates data in the provided area.
3.	Village Cadres	Village cadres have the authority to input house data and manage data on LFR for each village in Kediri Regency..

3.3 Class Diagram

Figure 3.3 is a class diagram of the Geographic Information System for the Distribution of Larva Free Rates in the Kediri City

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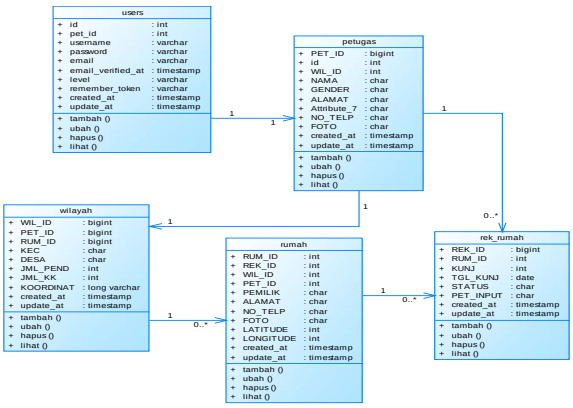


Gambar 3.3 Class Diagram

3.4 Diagram Architecture

The architecture in the work process of the geographic information system larvae free rates in Figure 3.4 shows the architecture that is owned by the system. Users of the geographic information system for the distribution of larva free numbers consist of admins, officers, and village cadres. The server provides data intended for admins, village officers, and cadres to manage data..

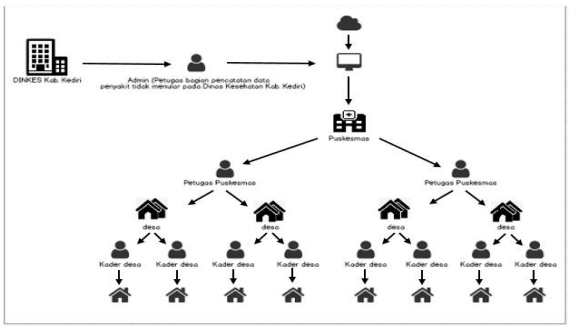
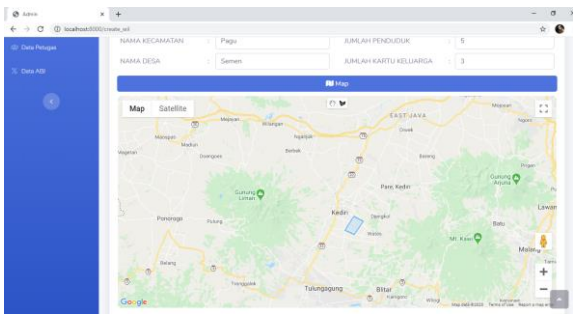


Figure 3.4 Diagram architecture

The Health Office divides several regions, and each region has officers who work to recap the larva free rates data in each puskesmas. There are cadres to manage LFR data in each house in villages in the area. Furthermore, a computerized system will manage the survey data and be uploaded to the Geographical Information System for the Distribution of Larva Free Rates in Kediri City.

4. Result and Discussion

4.1 Add Polygon Region Area



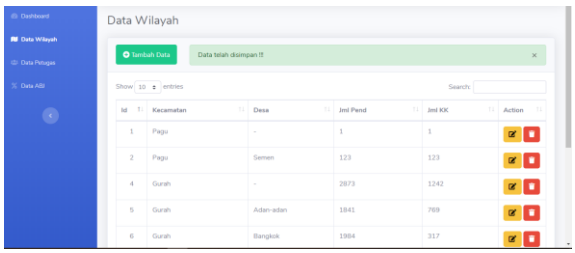


Figure 4.1 Add polygon region data

Figure 4.1 shows the test added data areas owned by the system. In this case, the officer adds data by drawing a polygon of the area and then entering the details of the area, such as data from the district, village, number of households, and population

4.2 Addition of House Data

In adding data to the house recap, the officer inputs the owner's name, address, telephone number, and photos of the houses of the residents who are used as survey samples and shown in Figure 4.2.

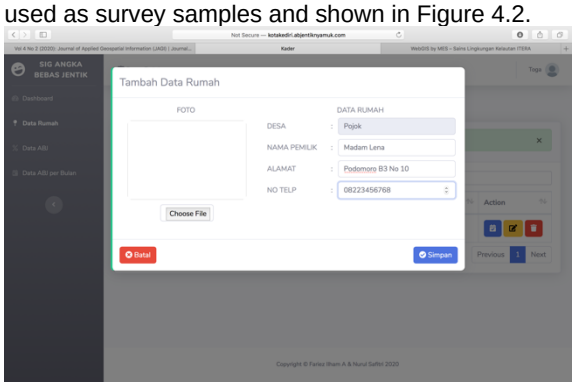


Figure 4.2 Addition House Data

4.3 Addition of House Recap Data

Field officers or cadres carried out the addition of house recap data to obtain the results of mosquito larvae free rates in a particular area. Visits made by cadres to resident homes are carried out every 3 months in 1 year. The officers carried out the data input, namely the input of visits to how many times, the date, and whether there were mosquito larvae in the residents' houses.

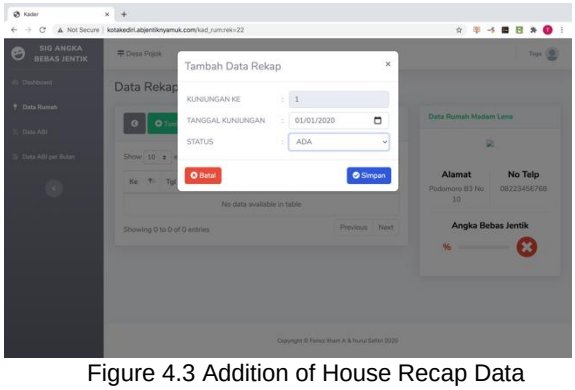


Figure 4.3 Addition of House Recap Data

4.4 Results of House Recap Data

Every time a cadre collects mosquito larvae numbers, it will always be recorded in the system, as shown in Figure 4.4. The cadres did visit the residents' houses and then record whether there were mosquito larvae or not in the houses of the residents who were the samples.

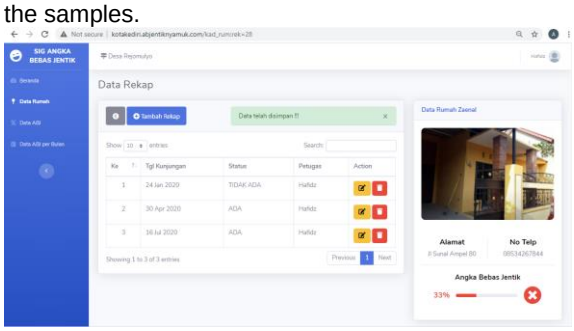


Figure 4.4 Results of House Recap Data

4.5 Larva Free Rate Data Per Cadre

After the cadres survey mosquito larvae, detailed data will be obtained regarding the status of LFR from each house that has been surveyed. This data is then displayed in the form of ABJ data recapitulation per cadre based on the village where the cadre works. The representation of the results can be seen in Figure 4.5 below

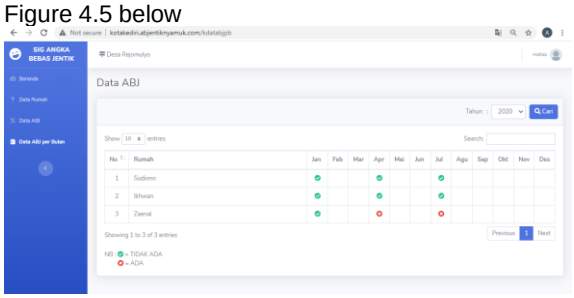


Figure 4.5 larva free rate data per cadre

4.6 Larvae Free Rates Data per Urban Village

From the recapitulation process carried out by several cadres in a sub-district area, the data will eventually be calculated and displayed in polygons per urban village area in Kediri, and show different colors. The polygon are divided into three colors, namely the red color to represent the larva free rate below 50%, the yellow color to represent ABJ in the village area with a value of 50-80%, and the green color to represent the area of the sub-district where ABJ meets above 80%. These data is shown in Figure 4.6.

4.7 Larvae Free Rates Data per District

The data in Figure 4.7 shows the final result of the Larva Free Number data collection application in the City of Kediri, which is shown by polygons with several different color representations. From the results of the ABJ survey that had been conducted by cadres in various RT areas within the sub-district in Kediri City, it was found that the three existing Districts showed different Larva Free Rates. Mojoroto District is a sub-district in the City of Kediri, where the larva free rate is below 50%, while the Pesatren District is in the yellow zone, which is the ABJ value between 50-80%. The third sub-district in the City of Kediri, namely the Kota District, is an area that meets the required standard larva free numbers, and in data, representation is displayed with a green polygon.

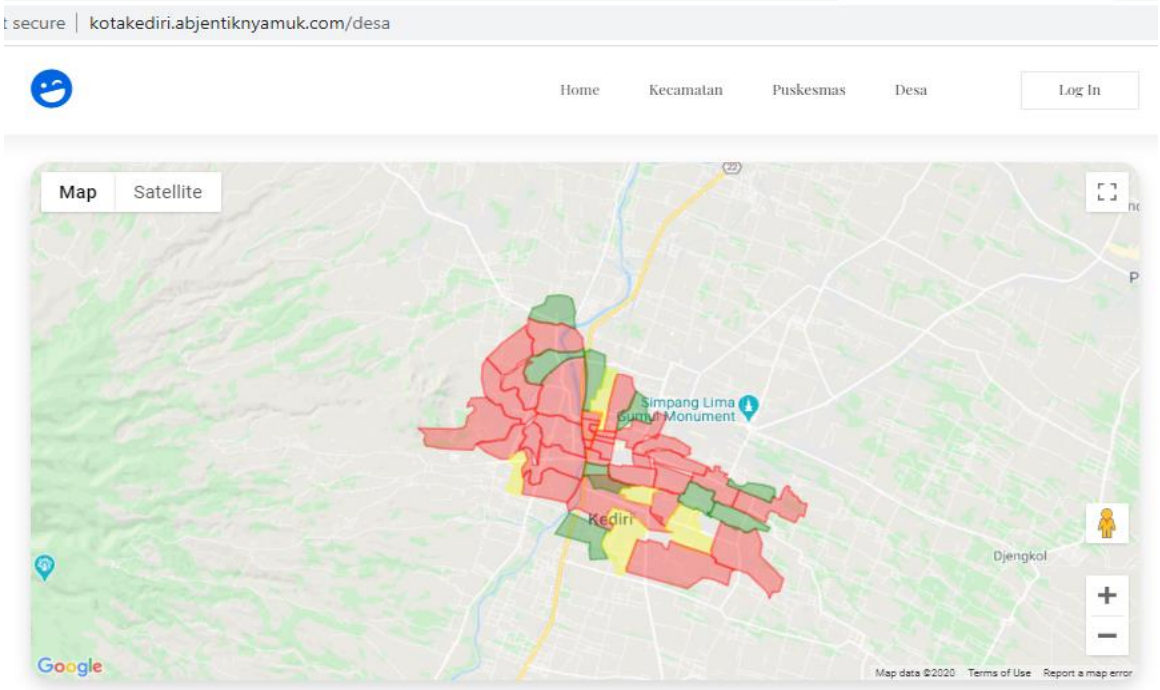


Figure 4.6 Larva Free Rates Data per urban village area in Kediri City

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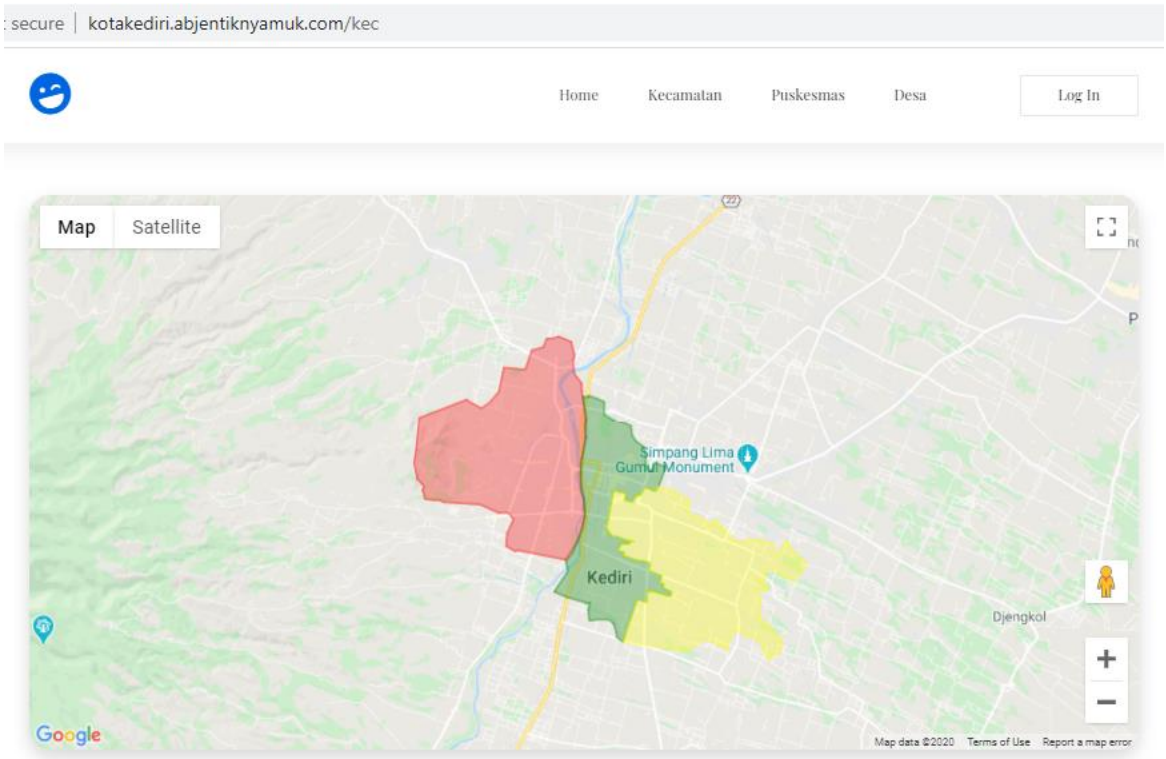

Figure 4.7 Larva Free Rate data per district in Kediri City

Analysis of research results is used to determine whether system testing has been successful or not. Black box testing is conducted to see whether the application features that are being developed already work well or not as shown in the table 5.1

Table 5.1 Blackbox Testing Result

Num	Scenario	Expected Result	Description
1	Database connection	Application appear in browser	Valid
2	Display regional data	CRUD Regional data	Valid
3	Display urban village Data	CRUD urban village Data	Valid
4	Display House Recap Data	CRUD House Recap Data	Valid
5	Display Larva Free Rate Data	Larva Free Rates is displayed	Valid
6	Display Map Data	Map Data is displayed	Valid

4. Conclusion

This research concludes that the Geographical Information System for the Distribution of Larva Free rates in the City of Kediri has been successfully designed and built. Hence it can recap the larva free number data using a web browser and display the distribution of larva free rates data in polygon form on a map.

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