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Website Based Geographic Information System for Road Damage Mapping in Banyuwangi Regency

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ABSTRACT

Roads are critical infrastructure and influence the life of the nation. Good roads support the running of the economy and the comfort of road users. Banyuwangi Regency has diverse geographical characteristics ranging from lowlands, hills, highlands, and coastal areas. Road damage that is not well managed due to lack of control and public complaints. Thus, maintaining and developing a good and appropriate road network is a top priority for regional governments to increase regional economic growth, inter-regional connectivity, and safety for users of transportation facilities. Mapping road damage using a geographic information system (GIS) can help monitor and provide detailed information regarding road damage at certain points. Using websites to facilitate GIS performance can make road handling more accurate with real-time public reports via the website. The development research in this study uses the System Development Life Cycle (SDLC) model with the Agile method. The design uses UML to make it easier to create a system and build a system using the Laravel framework.

Keywords:
Geographic Information System Road damage mapping

INTRODUCTION

The road is very important and influential infrastructure for life nation . Good road become supporter walking wheel economy and comfort user road (Nasution et al., 2021) . Apart from being means transportation , roads also have role strategic in support sector agriculture , industry , trade and tourism (Kanwal et al., 2020; Putri, 2019; Wati, 2021) . Adequate roads will make it easier transportation results agriculture from village to the market, facilitating distribution goods from industry to consumers , as well give more access Good for tourists who want explore beauty nature and culture of Banyuwangi (Gibbons et al., 2019) .

Regency Banyuwangi own characteristics geographically diverse from start plain low , hills , plains high and coastal areas (Sambah et al., 2020) . As it goes time mobilization public the more increases and so do the loads company expedition that has weight Enough heavy to be supported by the road . That matter can influence condition road That itself and results Damage to the road . Damage road can influence mobilization and security user possible path hinder economy . So that must exists maintenance and repairs road (Giovani et al., 2020) .

Maintenance and development network good and right way become priority main for government area in effort increase growth economy area , connectivity between area and security user facility transportation . With do mapping damage road , government regions and institutions related can identify with appropriate location and level damage road . Information this is very important For set priority repair . Areas that experience damage critical or possible damage bother smoothness Then cross can prioritized For repaired moreover formerly . Mapping damage you can also walk know location and type damage road in detail, source Power like budget and manpower Work can allocated with more efficient . Mapping damage road help government in plan and manage budget repair infrastructure with more appropriate target .

In research previously carried out by (Zahara et al., 2021) and (Yeremia et al., 2024) state that system information geography is very important Because can give detailed information about their objects thorough . Information obtained from mapping damage road help in taking data - based decisions . Point damage There are no roads in Banyuwangi district yet There is report in a

way clear point coordinates , extent of damage and other detailed information . Apart from that, media reporting damage roads and mapping damage road in real-time yet is in Banyuwangi district . Therefore That system information geographical mapping damage road he Use of the website in makes it easier GIS performance can make handling road become more accurate with report public in real-time via the website.

With develop rapidly device soft , selection methodology development and tools Proper design is very important For ensure success and ability adapt project . In research This researcher explore development A system with using the System Development Life Cycle (SDLC) model, in particular apply the famous Agile method with approach iterative and incremental . Agile SDLC makes it possible bait continuous feedback and adaptability , ensuring that stakeholders ' needs continued interest develop can fulfilled with consistent .

For in a way effective capture and communicate needs and design system , Unified Modeling Language (UML) is used (Zahara et al., 2021) . UML offers standardized visual language build , and document channel from A system device soft , so become very valuable tool for developers and stakeholders interests (Abdillah, 2021) . The combination of Agile SDLC and UML does not only increase flexibility and responsiveness of the development process , but also ensuring clarity and precision in design system .

METHOD

Method used in develop this system using the System Development Life Cycle (SDLC) model and implementing AGILE method . The AGILE method in the SDLC model is flexible method because stages stages carried out over and over again adapt with need . This method provide high success rate and more fast compared with method other . (Hutauruk & Pakpahan, 2021; Nova et al., 2022)

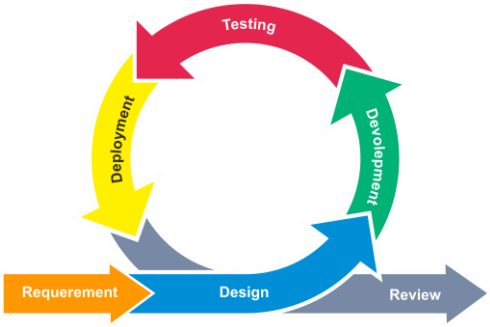

Figure 1AGILE method

Requirement or plan stages are carried out For identify need user in build a mapping system damage road such as damage data path and object coordinates . Information This collected from various source For get complete data about need user . Furthermore Design stage is carried out For give description to the system to be developed based on existing data obtained For understand in a way complete about What should done . At the author's Development stage use code programming For translate design and analysis system to in language that the computer understands , produces system appropriate information with planning as well as test its functionality . After system developed , stages carried out namely Testing. Testing is a verification and testing process system in a way comprehensive For identify possibility failure or error . Deployment is the stage at which the application has been developed distributed by the developer . Finally , the Review stage is carried out For check response from users who use application , make sure that need they has fulfilled and for get bait come back To use repair more carry on .

RESULTS AND DISCUSSION

Study This produce invention that mapping damage using information systems geographic and information damage road in real-time is really needed For help government and society in monitoring condition roads , repairs roads , and information other . Society doesn't know point

damage road latest so that harm to Society. With do identification problem done find a number of system requirements that can be done implemented . Following a number of capable system design implemented .

System design

System design used in the study case study This using a suitable Unified Modeling Language (UML). applied to systems based on Object-Oriented Programming so that writer choose UML as system design .

1. Use Case Diagrams

On research This use case diagram displays the 3 entities involved in use case diagrams. Apart from admin users and also heads service can see which main map features the displays mapping damage the way it happened without must log in to your account moreover formerly so that later make it easier use . besides Users can do that too input damage data a path that occurs in a roads in the Banyuwangi area will but the user must log in first formerly . If not have existing account registered so must do registration moreover formerly . Admin and Kadin only Can do something in accordance with arrows in the use case in Figure 2 below .

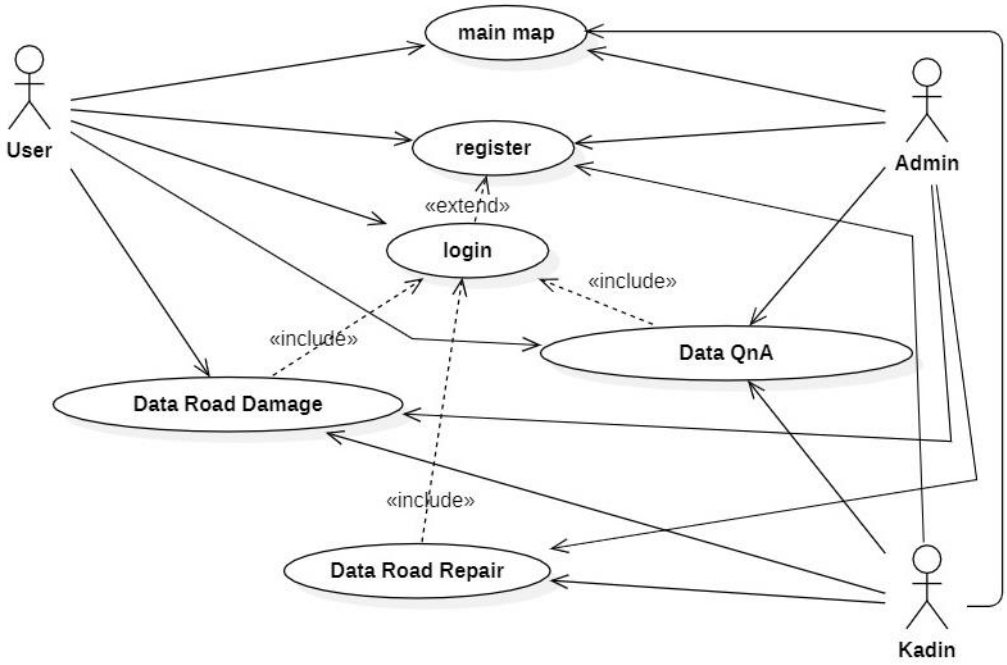

Figure 2. use case diagram

2. Sequence Diagrams

Sequence diagrams are depiction channel in a way schematic in accordance order time will passed . So the system can walk with Good in accordance flow that occurs . Sequence diagram that will explain system flow in the picture following .

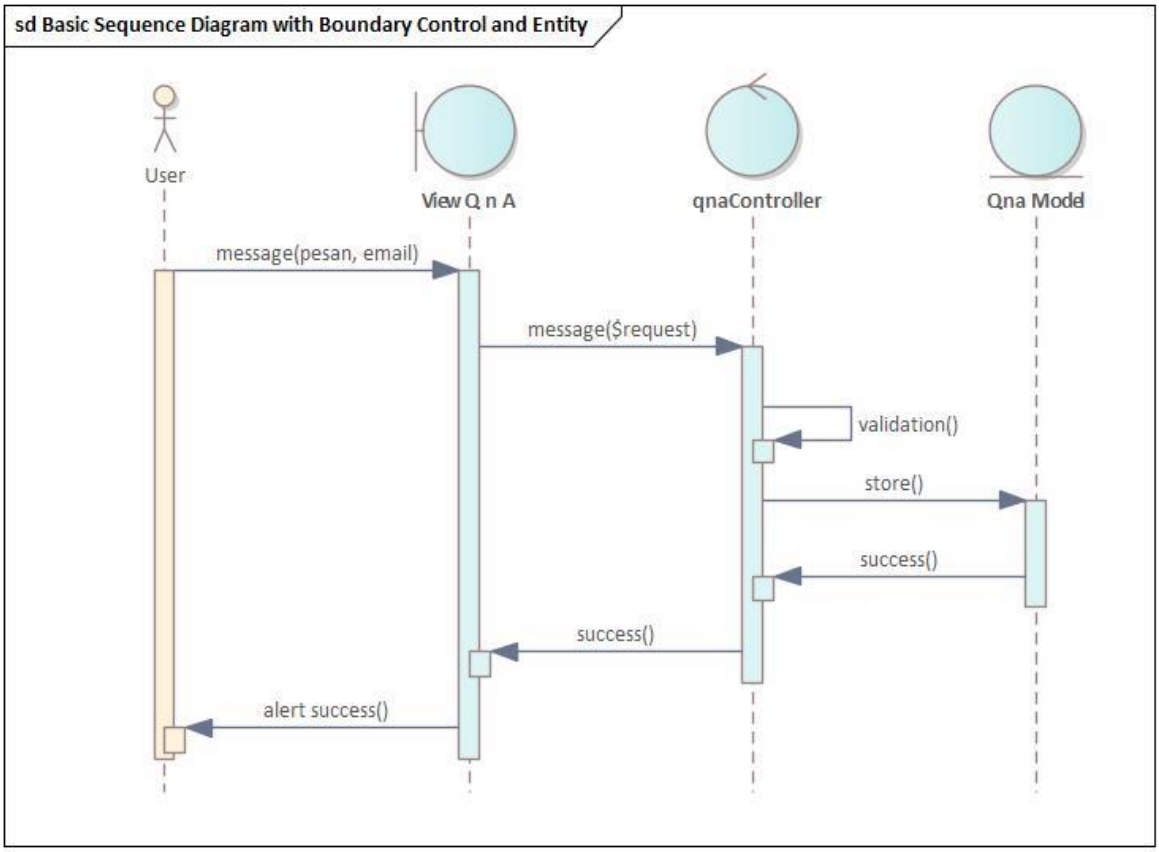

Figure 3. Sequence Diagram Question and Answer

In picture 3 above explain flow Qn Adari user input fast Then regulated by the QnA controller Then validated by the controller whether the data is complete in accordance . after That sent to model for saved to the database.

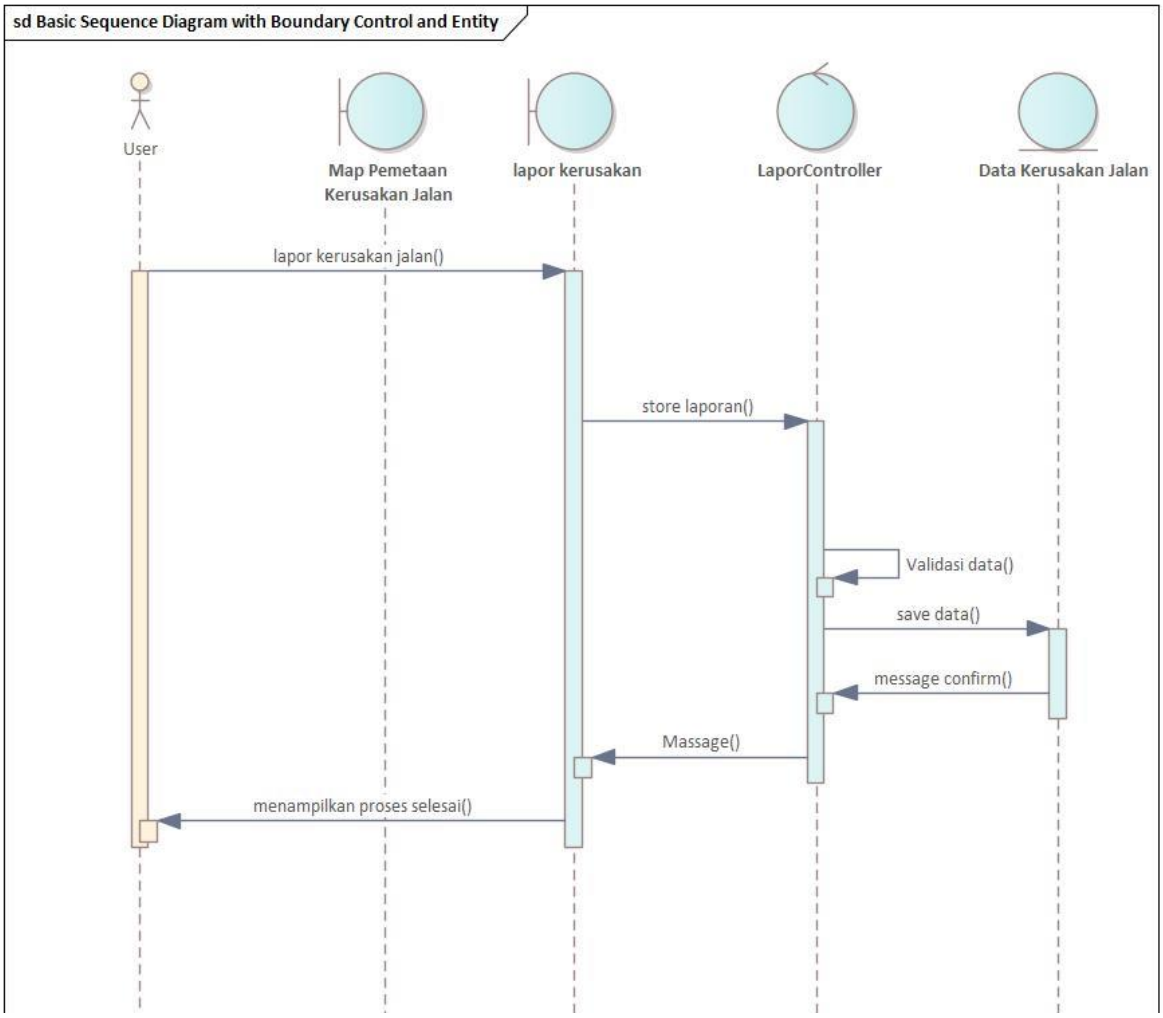

Figure 4. Sequence Diagram Map mapping damage road

In figure 4 it is process flow that occurs in the map feature with started with from user to to map view . Then the map will be request data to the database via the controller to request data and send data from the database to displays required information .

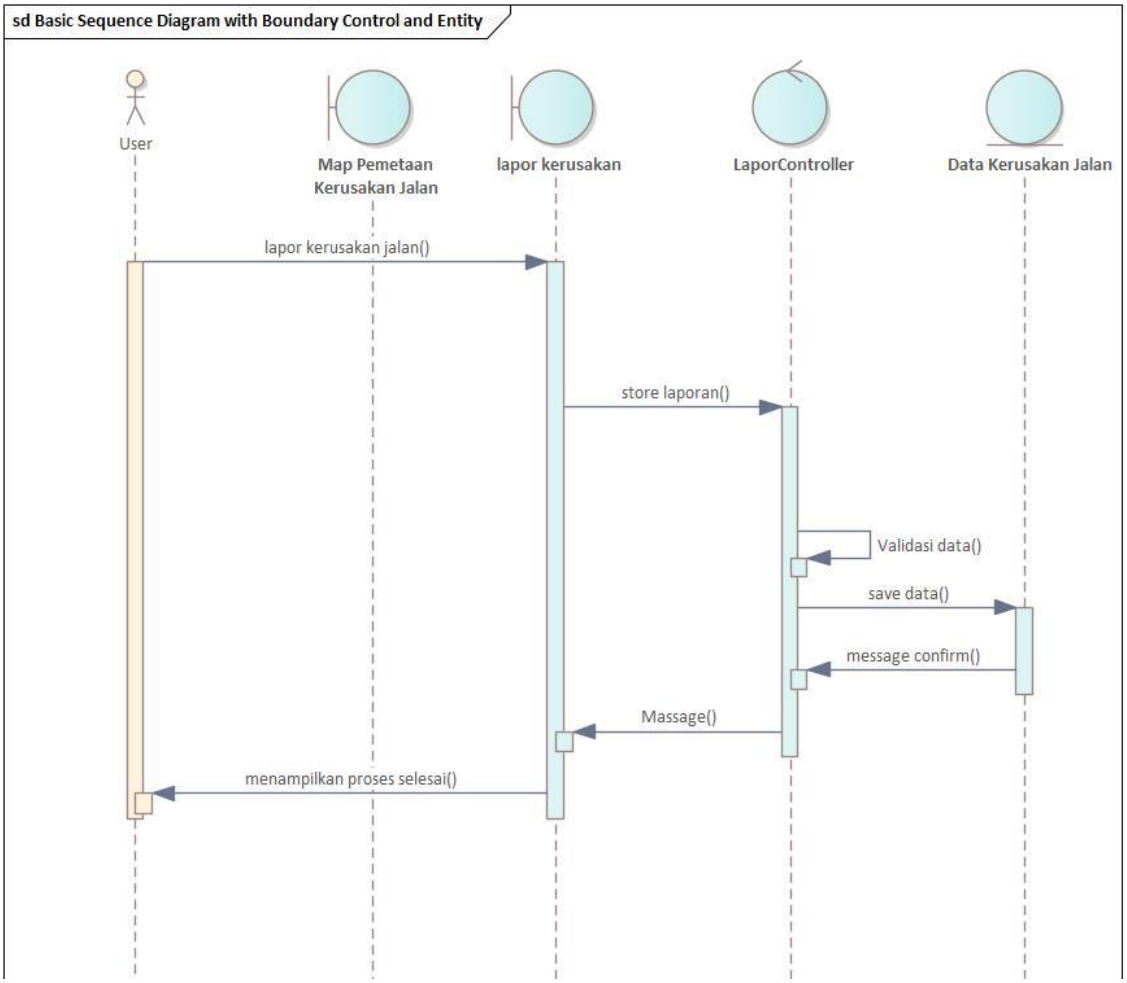

Figure 5. Sequence Diagram for Reporting Road Damage

In figure 5 above is processyang occurs when the user reports necessary damage through display the damage form road Then fill in the formula and data later will validated by the controller whether the data is Already in accordance provision . After validated Then stated to the later model will entered to the database by the model.

3. Activity Diagrams

For know the processes carried out by each entity so activity diagram is required as design running of the system. Activity Diagram that becomes description like following .

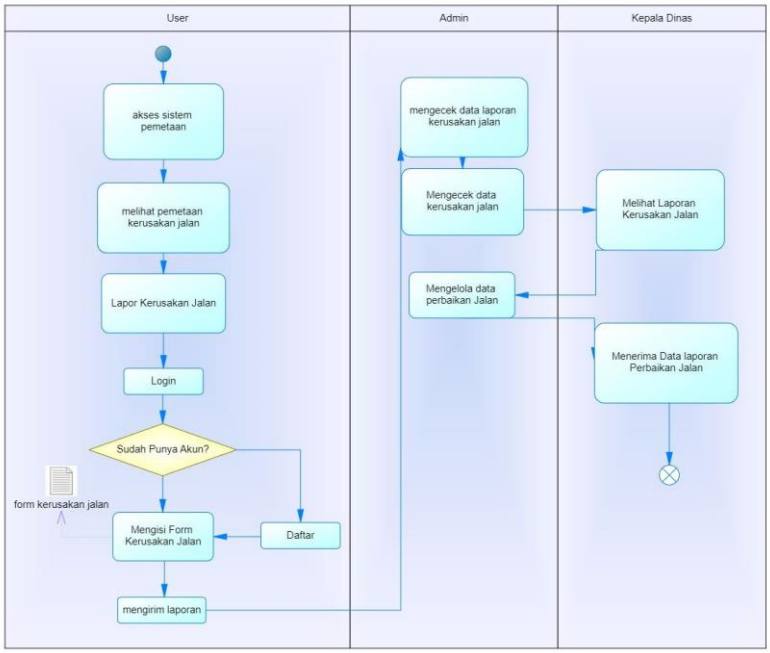

Figure 6Activity Diagram

The diagram in Figure 6 is description flow carried out by 3 entities where the user is the community that will do reporting road damaged with a number of mandatory provisions be equipped before report and it's there a number of activities carried out by admin and Kadin.

4. Class Diagrams

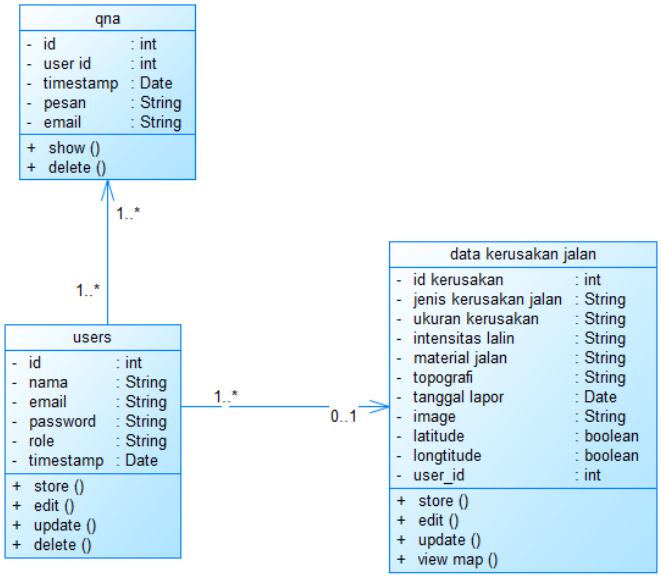

Figure 7. Class Diagrams

In the class diagram image above describes the class that will be built and implemented into the system. There are 3 classes implemented namely the damage data class path , Class QnA , Class User. In that class there is a number of must attribute fulfilled and there is a method for operate order certain .

Implementation

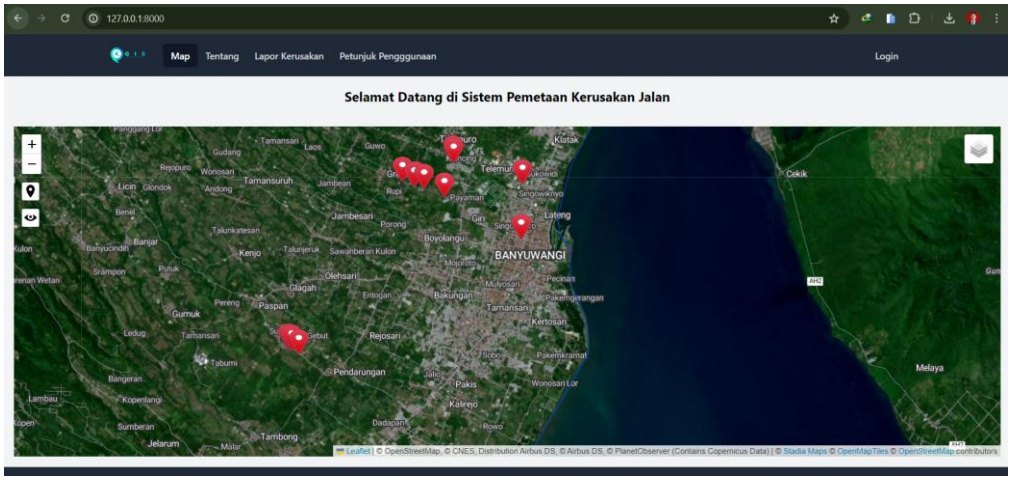

Figure 8. Website Interfaces

Mapping website display damage road figure 8. like on with displays location damage road with marked by a sign red . Apart from pictures map there are also features that can accessed above map like report damage , instruction use of the system, about the system. And some features found on the map such as zooming in, zooming out, showing the boundaries of the Banyuwangi area. Displaying location device is at .

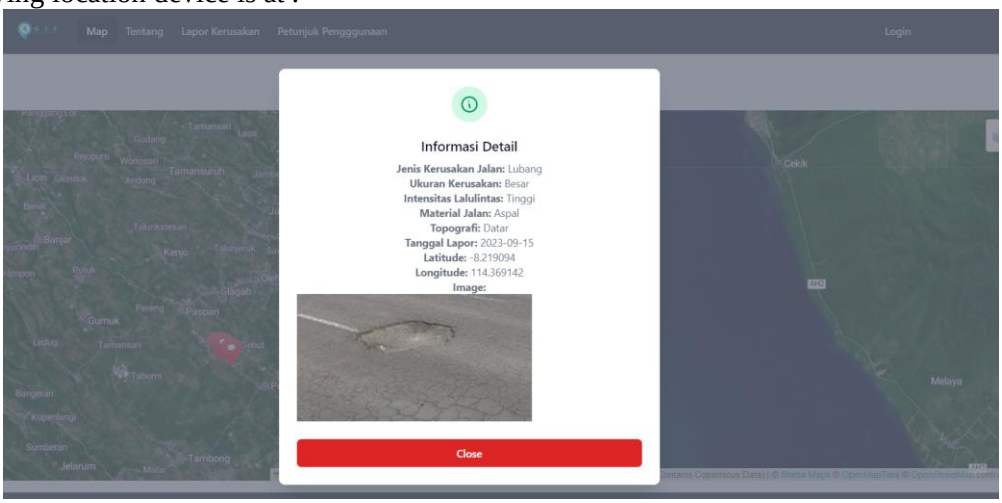

Figure 9. Interfaces Detailed Information

When sign red pressed will appeared detailed view like Figure 9. Above shows text information and also images damage road .

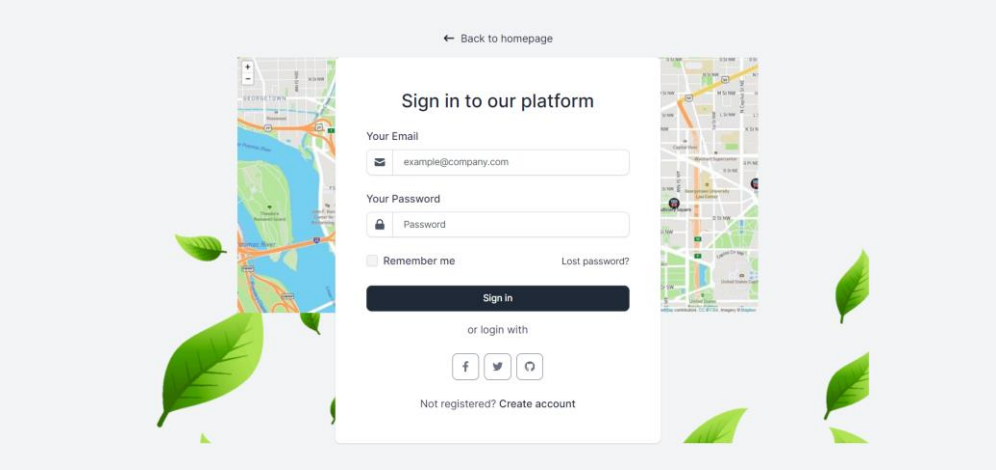

Figure 10. Interfaces Login

Figure 10 above is Login display with email form, password and login using Google, Facebook and X.

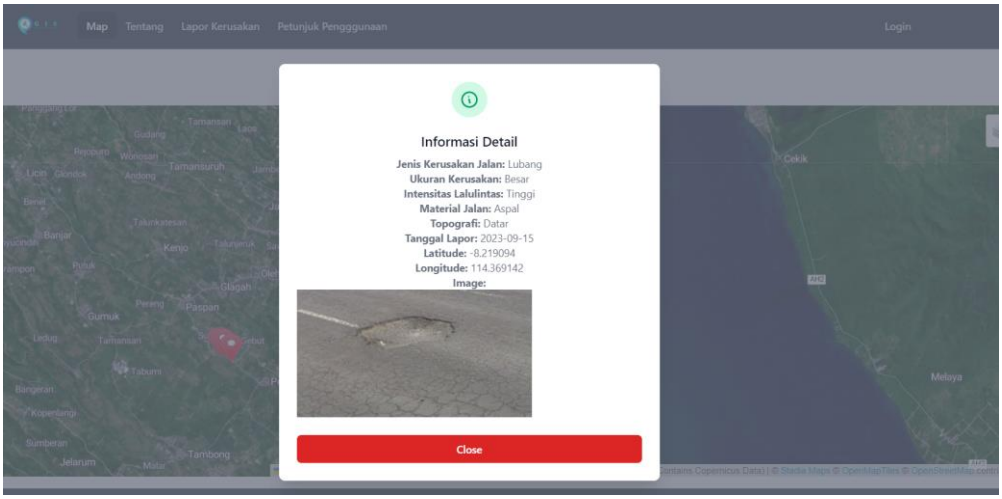

Figure 11. report form damage road

In Figure 11. This is a report form damage containing road a number of required input filled like type damage road , size damage , intensity traffic , road materials and more there is a number of Again .

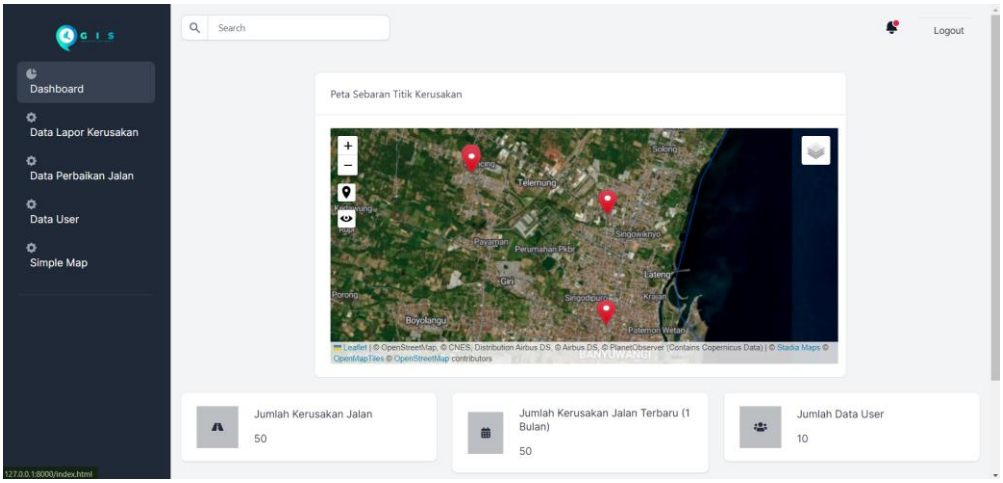

Figure 12. Interfaces Dashboards

Appearance the system dashboard contains map damage road Jan several cards that provide information amount damage , amount of user data, and the latest incoming data . And still Lots Again .

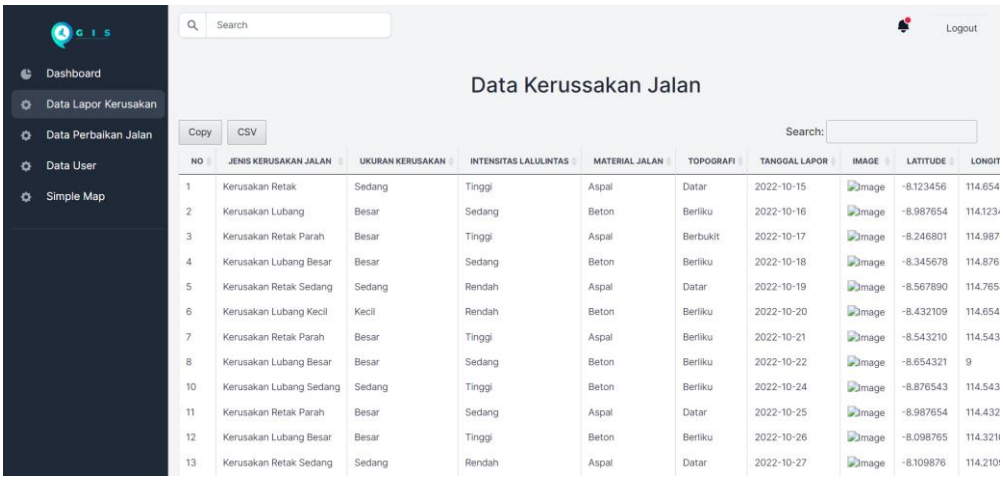

Figure 13. Interfaces data damage road

In Figure 13 is a table of damage data a number of columns and features search along with exporting data to Excel.

CONCLUSION

This research has succeeded in developing a geographic information system for mapping road damage in Banyuwangi Regency. This system was designed using the System Development Life Cycle (SDLC) model and Agile methods, and implemented with the Laravel framework. System design was carried out using Unified Modeling Language (UML) to facilitate the development process.

This geographic information system allows real-time monitoring and reporting of road damage via the website. The public can report road damage points along with detailed information, such as coordinates, type of damage, size of damage, traffic intensity and road materials. This information is very useful for local governments in identifying road repair priorities and planning budgets more efficiently. With this system, it is hoped that the maintenance and development of the road network in Banyuwangi Regency can be carried out better, thereby supporting regional economic growth, inter-regional connectivity and the safety of users of transportation facilities.

Suggestion

There are several suggestions for this research, namely:

1. Integration with External Data

   Integrate the system with traffic data, weather data and other geographic information to obtain a more comprehensive analysis in determining road repair priorities. This will increase accuracy and efficiency in managing road infrastructure.
2. Increasing Community Participation

   Carry out outreach and campaigns for the public to actively participate in reporting road damage through this system. Greater community participation will produce more complete and accurate data, making it easier for local governments to manage road infrastructure.
3. New Feature Development and Technology Integration

   Develop real-time notification features, expand system coverage to other areas, and integrate with drone or autonomous vehicle technology. This will increase the efficiency of monitoring road damage, facilitate coordination between regions, and utilize the latest technology to obtain more accurate and up-to-date data.data to Excel.

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