Research Article

Mapping and Monitoring of Satellite-based Livestock waste Management and Internet of Things in Livestock areas in Bumiaji, Batu City

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Abstract: Global Positioning System (GPS) and Internet of Things (IoT) technology significantly monitor livestock waste, which is vulnerable to environmental pollution. The potential for livestock waste is relatively high if a good and maximum management process is carried out. The role of GPS is to provide specific data, i.e., latitude and longitude points, where this position is essential to providing detailed data on the status of drainage and livestock waste originating and going to where. GPS data and its Mapping will be displayed on a smartphone's desktop and mobile-based graphic user interface. The role of IoT is to provide data in real-time with data taken from sensors installed in sanitation or drainage in the livestock area in the Bumiaji sub-district, Batu City. Furthermore, the monitoring points are located at several points in the Bumiaji sub-district, consisting of 9 livestock points located in one sub-district as a source or data source that will be sent via IoT devices and displayed on a map using GPS technology in real-time at the research location. The real-time monitoring results can be monitored through data provided by sensors, which will then be executed and handled directly to anticipate environmental pollution.

Keywords: satellite; internet of things; monitoring; waste; livestock; GPS Accuracy

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1. Introduction

One of the most significant issues in the livestock community [1,2] is waste and how to manage livestock waste properly and efficiently, especially in the Bumiaji sub-district, where the people are busy and most of their jobs are farming. Excellent and efficient management and a real-time monitoring system to guard against unwanted things such as water pollution, such as river water pollution, need to be improved.

The Batu City Government, through the Batu City Environmental Service, continues to evaluate and monitor how to solve livestock waste problems. The community, in this case, the farmers, must also take part in maintaining the health and cleanliness of the environment, at least maintaining the absence of waste pollution generated from their farms. According to several previous researchers, liquid waste from livestock has polluted several water streams, which automatically changes the pH of the water [3,4].

This real-time monitoring system can use Global Positioning System (GPS) technology and Internet of Things devices to obtain real-time data in livestock areas in the Bumiaji sub-district, Batu City. The way to get real-time data is with internet-based devices such as desktops, laptops, and smartphones. This system will make it easier for the Environment Agency (DLH) to monitor in real-time the condition of the waste flow produced by the livestock area in the Bumiaji sub-district at various points and whether there is a tendency to cause environmental pollution.

The problem in the livestock area in Bumiaji sub-district, Batu City, is the vulnerability to livestock waste pollution near residential areas. Therefore, a participatory and sustainable waste management plan is needed. Questions that can be submitted in research or studies include: [1] How is livestock waste management in Bumiaji District, Batu City, through GPS and IoT technology monitoring? [2] What efforts should be made to manage livestock waste and organize livestock areas in the Bumiaji District, Batu City, with real-time monitoring and post-monitoring efforts based on IoT?

2. Theory

1. Livestock Waste

Keeping the environment clean is our shared responsibility; farm owners are no exception. Businesses should not only think about the economic aspect but also the health aspect of the environment. In the livestock industry, environmental issues are no longer new, but only a few companies have implemented a zero-waste system. The term zero waste is a system that supports the creation of a clean, safe, healthy, and zero-waste environment. This can be accomplished by encouraging livestock companies to integrate with agricultural companies, plantations, or other companies. Data from the Central Statistics Agency (BPS) shows that there are at least 140 legal livestock companies in Indonesia.

According to the 2018 Animal Husbandry and Health Statistics, beef cattle in Indonesia have 17,050,000 million heads, 550,000 dairy cows, and 1,356,000 buffaloes. For small ruminants, the population of goats is 18,721,000, and the number of sheep is 17,398,000. Each animal usually excretes feces 6-8 times per day and expels 8 percent of its body weight. Imagine how much livestock waste is released every day in Indonesia, not including urine waste and wasted feed waste. If left untreated, this can have a negative impact on the environment.
Moreover, Livestock waste consists of solid waste, liquid waste, and gas waste. Solid waste is in the form of feces, feed waste, and carcasses, while liquid waste is in the form of urine. Fecal and urine waste allowed to accumulate around the cage area causes a lot of bacteria and triggers the growth of viruses that will impact the number of livestock affected by the disease. However, waste that is disposed of carelessly can also pollute the surrounding environment. As a result, skin diseases experienced by residents around cages, such as itching, are often blamed on livestock companies.

Another livestock waste [8,9,10,11,12] is methane gas (CH4) which comes from belching, cow farting, and cow feces. Methane gas is an odorless gas that causes the greenhouse effect that causes global warming. About 5 percent of methane gas is produced from agricultural activities (including livestock). Of this amount, the ruminant livestock sector accounts for 60 percent. The Food and Agriculture Organization (FAO) report states that methane gas produced by livestock and agricultural activities has continued to increase over the past 50 years. However, research by IPB University shows that methane gas from livestock activities can be reduced using rations with feed ingredients containing tannin.

Moreover, Livestock industry waste can be utilized as a valuable byproduct. We may commonly see biogas installations in the homes of smallholder farmers; this is one of the efforts to utilize waste so that it is not wasted. Farmers can use biogas containing methane gas and carbon dioxide (CO2) to turn on the stove as a substitute for LPG gas and generate house electricity. Livestock companies can integrate with energy companies by utilizing methane gas from livestock activities.

The utilization of feces and urine waste tends to be neglected at the smallholder farm level. The stigma of smallholder farms that consider their livestock as savings rather than business commodities makes the utilization of these byproducts of production not optimal. As a result, the waste is dumped in the river, polluting the ecosystem. In contrast, cow feces can be used as manure. The use of manure is very good for soil health. Manure keeps microorganisms and soil biota alive so that the soil is more fertile.

Ruminant urine can be processed as liquid fertilizer and natural pesticide. The urine content in the form of nitrogen (N) is what is used as fertilizer for plants. Processing is needed in the form of fermentation both anaerobically and aerobically so that urine can be used as fertilizer. Farmers can also use the distinctive smell of urine as a pest repellent for plants.

2. Zero Waste System

Some livestock companies that have implemented a zero-waste system can be an example for other companies in handling waste. For example, PT Great Giant Livestock (GGL), a subsidiary of the "*Gunung Sewu*" Group, integrates with PT Great Giant Pineapple (GGP), which is engaged in canned pineapple. The advantage of integrating a livestock company with pineapple plantations is that in addition to the waste that can be used to support plantation activities, the waste from harvesting pineapple plantations can also be used as animal feed. Pineapple peel waste has a high sugar content, making it a good source of energy for livestock [13,14,15].

In addition to large-scale livestock companies, smallholder farms also contribute a lot of waste. This refers to BPS data, which shows that small-scale farms or smallholder farms dominate the cattle population in Indonesia. Waste management at the smallholder farm level tends to be difficult to implement. The lack of knowledge of the farming community about the importance of protecting the environment in addition to focusing on production is homework for all of us to overcome; it is better for smallholder farms to come together to form livestock groups so that counseling on the utilization of livestock waste [16, 17,18,19,20] can be realized. In addition, by forming groups, farmers are also easily touched by government assistance such as biogas installations so that waste is not wasted. Another benefit is that members of the livestock group can work together for their members' welfare in terms of meeting the need for fuel from biogas.

The benefits of waste from ruminants need to be known by farmers who are still unfamiliar. In addition to encouraging economic efficiency and helping protect the environment from waste pollution. The intervention of the government, environmental activists, and academics is necessary to educate the farming community on the importance of good sanitation. An industrial wheel that moves without waste may be almost impossible to achieve. But reducing it to a minimum is still possible [21,22,23,24,25].

3. Map and Mapping Concepts

Mapping is a process of presenting information on the face of the Earth in the form of facts, the real world, both the shape of the Earth's surface and its natural resources, based on the map scale, map projection system, and symbols of the Earth's surface elements presented.

Moreover, the Map is a depiction of the state of the Earth's face in a flat plane. The Map is also a picture of the Earth's surface containing natural phenomena and artificial phenomena containing information needed in resource management in various fields of development, including the fields of spatial planning, forestry, plantations, agriculture, marine, mining, and so on. In general, a map is defined as a conventional picture of the Earth's pattern, which is depicted as if seen from above on a flat plane through a projection plane and equipped with writing for identification.

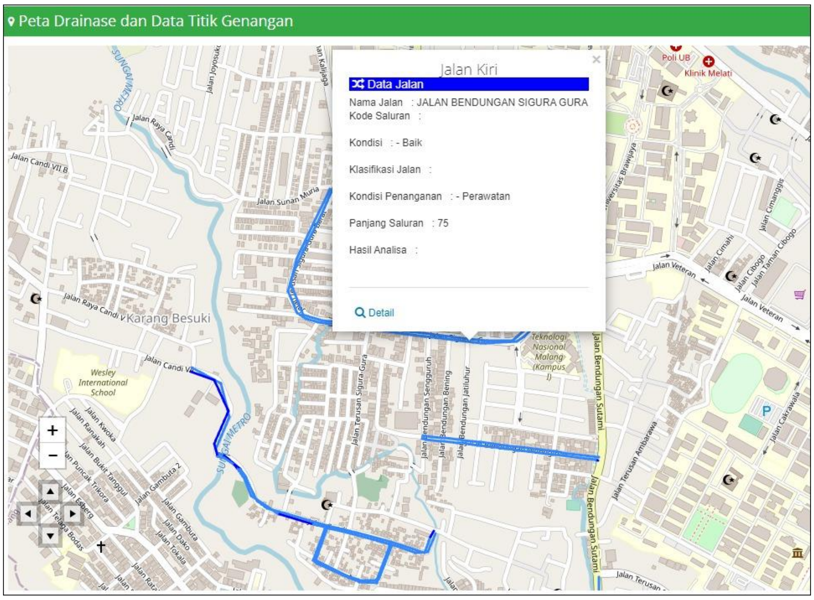


Figure 1. Drainage and inundation point mapping (Yudistiro. K, 2022)

Furthermore, a Map means communication. This means that it is a signal or channel between the message sender (map maker) and the message receiver (map user). Thus, the Map is used to send messages in the form of information about the reality of geographic phenomena.

A map is basically data designed to produce geographic information through organizing other data collaboration related to the Earth to analyze, estimate, and produce cartographic images. Spatial information about the Earth is very complex, but in general, geographic data contains four important aspects (Zhou, 1998):

1. Spatial locations are typical spatial objects in the coordinate system (projection of a map).
2. Attributes (material characteristics), information that describes the necessary spatial objects
3. Spatial relationships, Logic, or quantitative relationships between spatial objects
4. Time is the time for data acquisition, attribute data, and space.

Moreover, Mapping is a process of presenting information on the Earth's surface in the form of facts, the real world, both the shape of the Earth's surface and its natural resources, based on the map scale, map projection system, and symbols of the Earth's surface elements presented.

The presentation of the Earth's surface elements on the Map is limited by the paper border and grid or graticule. Outside the boundaries of the map area, various information is generally included, which is called the edge. This edge information is included so that map users can use the map properly. The arrangement and placement of edge information is not an easy thing because all information located around the Map must show balance.

4. Global Positioning System

Global Positioning System (GPS) is a satellite-based navigation system consisting of at least 24 satellites. GPS works in all weather conditions, anywhere in the world, 24 hours a day, with no subscription fees or setup costs. The US Department of Defense (USDOD) originally put the satellites into orbit for military use, but they were made available for civilian use in the 1980s.

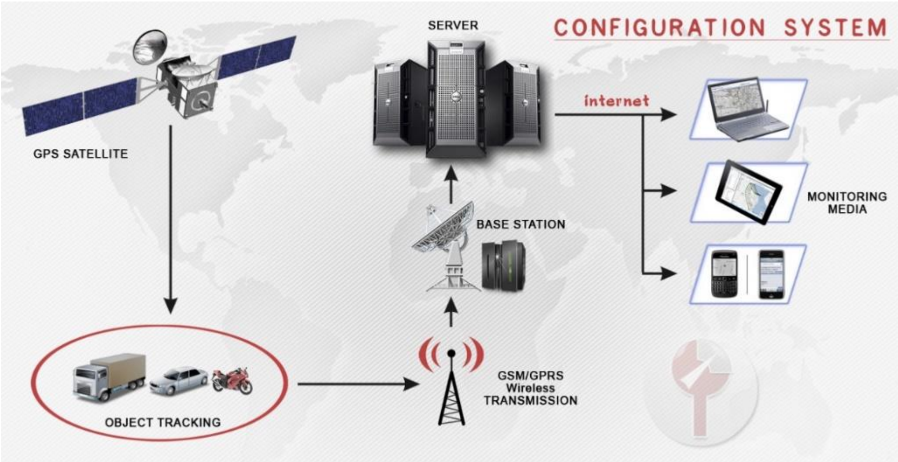


Figure 2. GPS Configuration

GPS satellites circle the Earth twice a day in precise orbits. Each satellite sends unique signals and orbital parameters that allow GPS devices to decode and calculate the satellite's exact location [5,6,7]. The GPS receiver uses this information and trilateration to calculate the user's exact location. Basically, a GPS receiver [10,11] measures the distance to each satellite by the amount of time it takes to receive the transmitted signal. With distance measurements from several more satellites, the receiver can determine the user's position and display it electronically to measure your running route, map a golf course, find your way home, or adventure anywhere. In this research, GPS is used to map the flow of water from livestock waste; wherever the water flows, monitoring is done in real-time based on Longitude and Lattitude data.

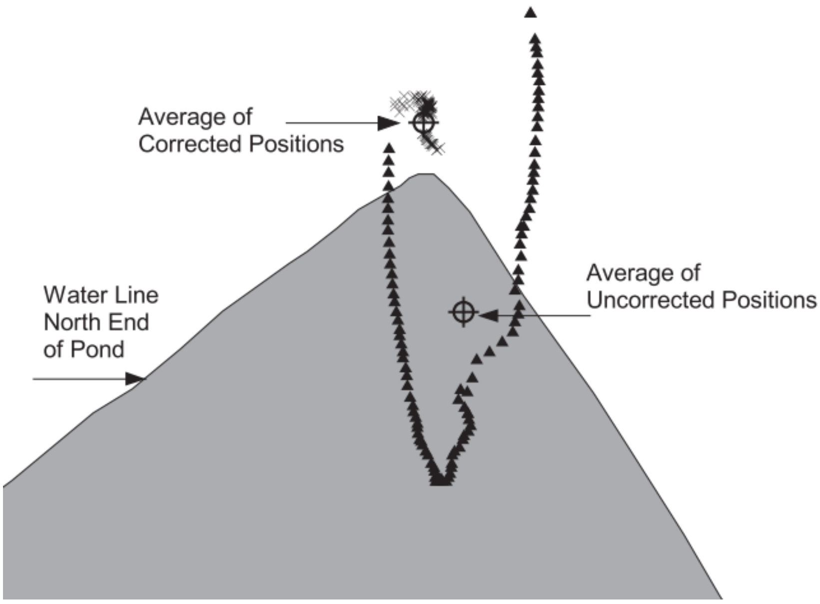


Figure 3. Location of Individual GPS Positions with Corrected and Uncorrected Average Positions for North End of Lake (Michael E. Garner's)

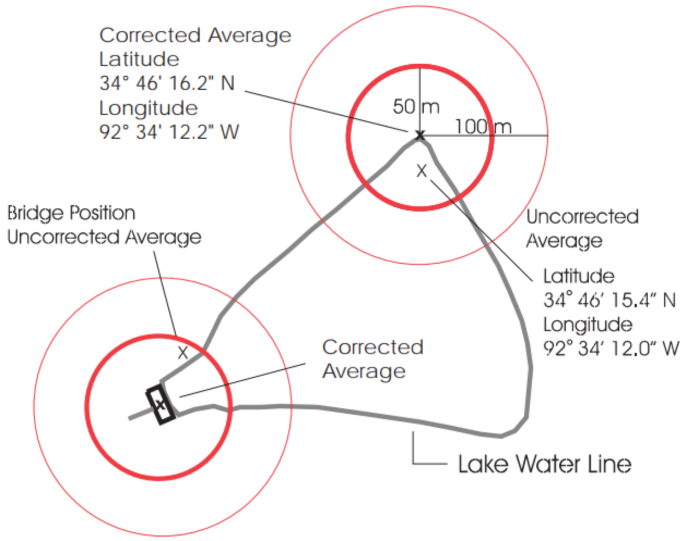


Figure 4. GPS Computed Coordinates Averaged but not differentially corrected (Michael E. Garner's)

Figure 3 and Figure 4 are the previous studies referenced by this research, namely Michael E. Garner's; in Michael E. Garner's research as a previous researcher on the same research, in this research, the points that can be taken are:

a. Provide examples of position errors for calculated GPS coordinates.
b. Draws attention to some common sources of GPS position error.
c. Relates GPS position error, expressed as distance, to errors in latitude and longitude.
d. Illustrates in general terms the effects of differential corrections.
e. Helps identify situations for differentially corrected coordinate positions

5. Graphical User Interface GPS-based

The system built is an interface system with Global Positioning System technology that has inputted the coordinate points of the waste stream from the farm in *Bumiaji, Batu*. Figure 5 shows the display of the SIPALIT GUI to login and see the full features. While Figure 6 is the Admin Dashboard page.

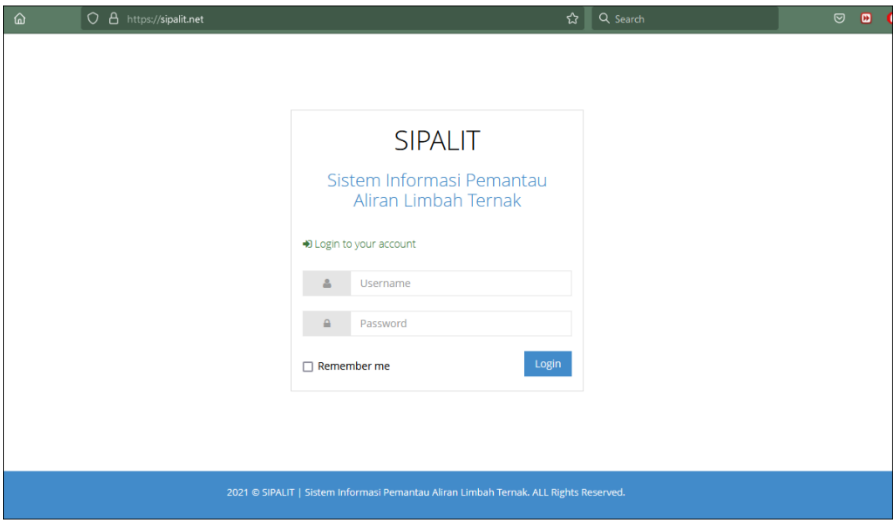


Figure 5. SIPALIT Login View

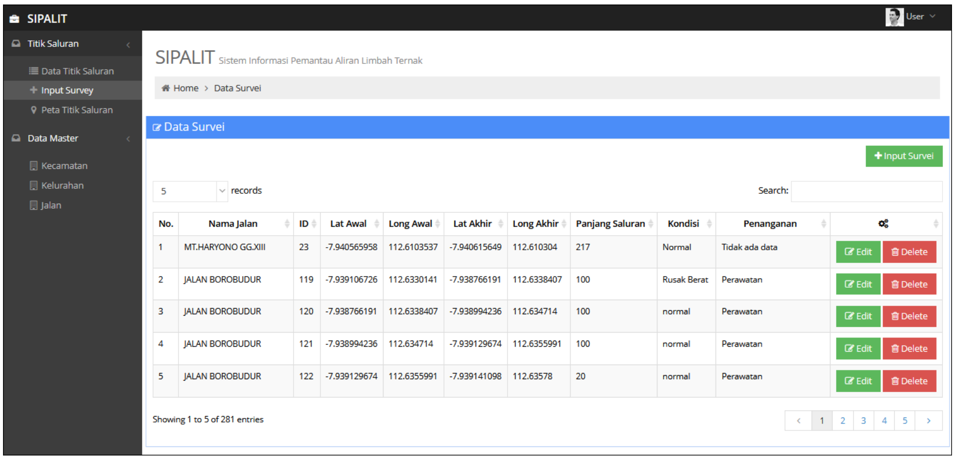


Figure 6. SIPALIT admin page

3. Method

The research method used in this research is the Descriptive Statistics Method, which is a method related to collecting or presenting data to provide useful information with specific devices, namely GPS and IoT technology as a source of information; IoT here is supported by sensors that are embedded at every point to provide information in real-time, which is then processed and analyzed, then how to follow up on the information provided. The following are the methods used in data analysis including:

1. Observation

Direct observation in the field of planning and design in Bumiaji District, Batu City, aims to provide an overview of the farm location's position and waste disposal flow from various points, which will be the basis of GPS and IoT-based Mapping.

2. Study of Literature

This data was collected through literature searches from books, journals, and websites on planning and design topics. It was especially designing maps based on real-time GPS and IoT.

3. Data analysis

Data from field observations, literature studies, and comparative studies were analyzed, and the existing local conditions related to the potential and quality of the area, as well as the condition of the community, were described in the process of forming a Graphical User Interface (GUI) based on GPS-based Mapping, specific data such as Longitude and Lattitude are needed, and taking photos at the Longitute-Latitude position from the Internet of Things (IoT).

4. Application of Design Concept

The Selection of concepts based on the results of each analysis can be applied to the existing conditions in Bumiaji District, Batu City. The design concept development is focused on making software or waste flow monitoring interfaces using GPS and IoT technology in the livestock area in Bumiaji District, Batu City.

5. Experiment

The experiment was carried out by monitoring livestock areas in the Bumiaji sub-district, Batu City, via satellite or GPS interfaces and IoT technology in real-time from several points or specific livestock areas in Batu City.

6. Knowledge dissemination to the public and questionnaires

The last method used is training the public and related agencies on this new technology regarding using tools and software for monitoring this real-time waste pollution monitoring system. The delivery model of this method uses table data and graphs to represent real-time data generated by the sensor end nodes embedded in each location equipped with Latitude and Longitude data.

They recall the problems faced by researchers as problem solvers or information service providers. Environmental pollution problems caused by livestock waste pollution can be solved with the technology offered.

Moreover, The research method used in this research is the Descriptive Statistics Method; descriptive Statistics method is a method related to the collection or presentation of data to provide useful information with a specific device, namely GPS technology and GPS GUI as a source of information, GPS system with GUI is used to provide specific information from the results of real surveyor data which is the source of information with point parameters and images with Longitude and Lattitude data, which then this information is processed and analyzed, then how to follow up on the information provided.

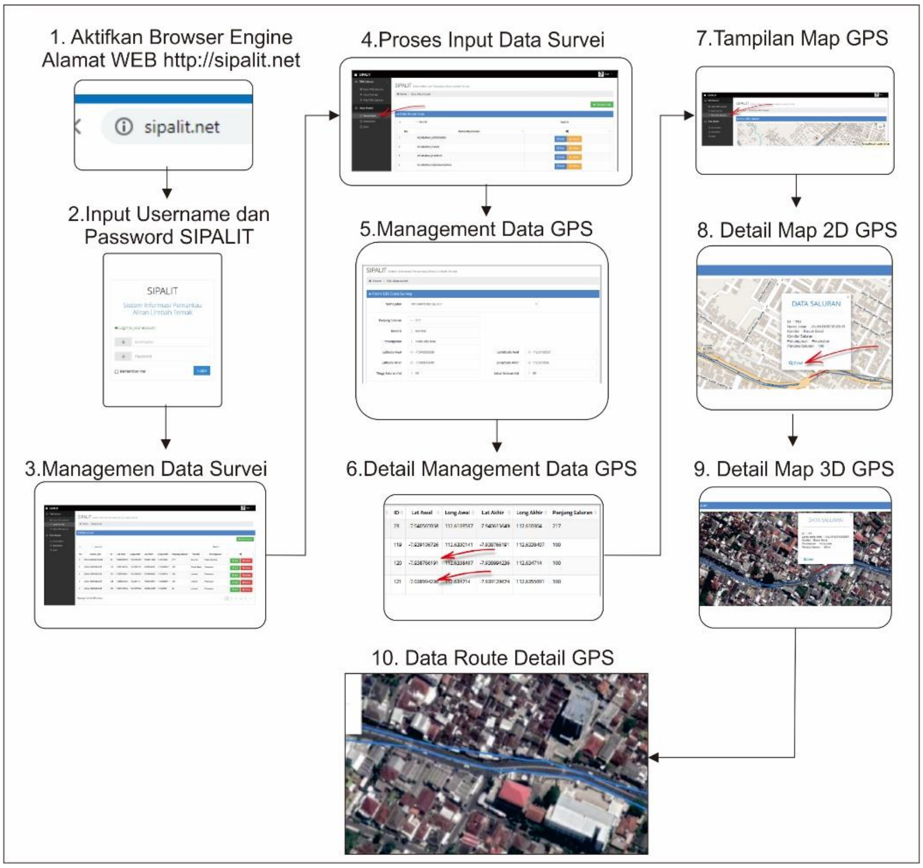


Figure 7. Flowchart system or How the system works

In this Research Method, Observation, Literature Study, Data Input, and Data Analysis are summarized in how the SIPALIT Program or Software works, illustrated in the flowchart. Basically, the data obtained comes from field observations and is continued with data input on the SIPALIT information system. At the same time, literature studies are references used in this thesis regarding the similarity of database-based data input systems used by SIPALIT and GPS, one of the technologies used during observation and location data collection. SIPALIT was built using HTML and PHP, as well as a MySQL database that has been integrated into a unified system. The method used in detail can be seen in Figure 7.

By recalling that, the problems that will be faced by researchers as problem solvers or information service providers to solve environmental pollution problems caused by livestock waste pollution can be solved with the technology offered. The specific train of thought of the research conducted can be seen in Figure 8.

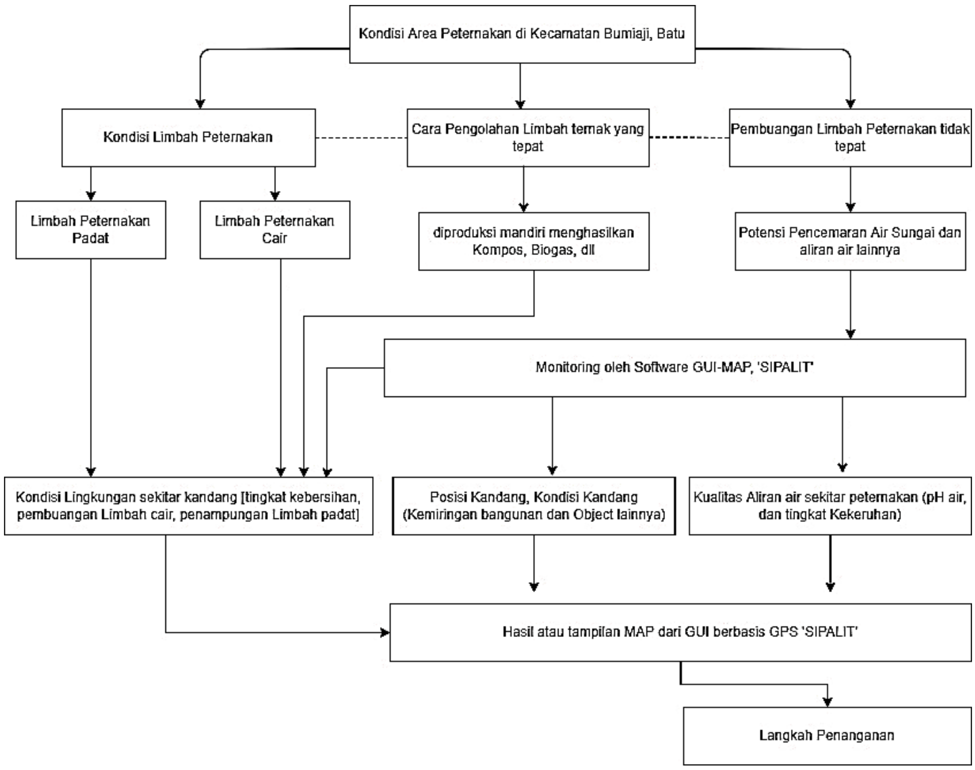


Figure 8. Specific train of thought of the research conducted

Moreover, solutions to problems and the role of GPS technology can be seen from the position of the Global Positioning System (GPS), monitoring the position and condition of all livestock areas in the Bumiaji Subdistrict. Furthermore, GPS technology is used to determine the longitude and latitude position of the waste stream position from the livestock area in the Bumiaji sub-district. This waste flow will be automatically recognized by GPS through an integrated Graphical User Interface (GUI) so that report data can be obtained quickly, precisely, and efficiently. This GUI-based software is called SIPALIT. An outline can be seen in Figure 8.

The methods used in data analysis include: [1] Observation, Direct observation in the field in planning and design in Bumiaji District, Batu City, aims to provide an overview of the position of the farm location, the flow of waste disposal from various points which will be the basis of GPS-based Mapping. [2] Literature Study: This data is collected through literature searches from books, journals, and websites on planning and design topics. Especially the design of GPS-based Maps and GPS GUI called SIPALIT Software. [3] Data Analysis: Data from field observations, literature studies, and comparative studies are analyzed, and existing local conditions related to the potential and quality of the region and the condition of the community are described. In the process of forming a Graphical User Interface (GUI) based on GPS-based Mapping, specific data such as Longitude and Lattitude are required, and photos are taken at the Longitude-Latitude position. [4] Application of design concepts: The Selection of concepts based on the results of each analysis can be applied to existing conditions in Bumiaji District, Batu City. The design concept development is focused on creating a software GUI or interface for monitoring waste flow in the livestock area in Bumiaji District, Batu City, using or utilizing GPS technology. [5] Experiments were carried out with monitoring via satellite or GPS interface and GPS GUI-based software to see the specific positions of livestock wastewater flow from several points or specific areas of livestock areas in Bumiaji sub-district, Batu city. [6] Knowledge dissemination to the community and questionnaires, The last method carried out is training this new technology to the community and related agencies regarding the use of software used for monitoring this waste pollution monitoring system. This method's delivery model uses tabular and graphical data to represent specific data shown in Graphical User Interface and Global Positioning System (GPS) based software through SIPALIT software.

Figure 9. Satellite and IoT-based Livestock Waste Monitoring System in Bumiaji District, Batu City

Solutions to Problems and the Role of IoT technologies and GPS technology can be seen from the following points:

1. Automatic detection of pollutant factors in livestock areas with IoT-based automatic water pH detection
   One IoT-based real-time monitoring system uses a water pH sensor installed in water areas such as rivers and streams. Installing this water pH sensor is essential to get real-time automatic water pH data via the internet, and it can be received quickly and in real-time using internet-based devices such as smartphones. This is one of the smart problem solvers to be able to answer the environmental pollution caused by livestock areas.

2. Detecting water turbidity around the IoT-based livestock area
   Turbidity is an indicator of whether a water flow or water reservoir object is polluted or not, so a water turbidity sensor is needed that can transmit data via the internet. Turbidity in water in livestock areas is deemed necessary for automatic detection as a form of automation detection or real-time monitoring based on the Internet or IoT.

   3) Detecting the condition of the cage, including the slope of the building or object around the IoT-based farm area, The slope of the cage or building or

object also includes things that should be detected, for example, the slope of a container for water storage, or it could be a cage building that is prone to collapse due to the material it is made of or seen from the sloping soil surface factor in the Bumiaji sub-district, Batu City which incidentally is a mountainous area that is prone to erosion of the soil layer due to landslides and other factors.

4) Global Positioning System (GPS) monitors the position and condition of the entire Livestock area in Bumiaji District
GPS technology is used to determine the position of Longitude and Latitude from the position of the waste stream from the livestock area in Bumaji District. This waste flow will be known automatically by GPS through the integrated Graphical User Interface (GUI) so that report data will be obtained quickly, precisely, efficiently, and in real-time.
Indicators:

1. Possible level of water pollution (highest to lowest)
2. Possible level of air pollution due to position in densely populated settlements (highest to lowest)
3. Cattle farming that affects soil quality
4. Cattle farming that detracts from the beauty of the area
5. Cattle farming causes other social problems (interfering with transportation access and other problems)

4. Result and Analysis

There are four methods used in this research, but one method is focused on in this paper: Reducing GPS Errors and improving position accuracy for zoning. There are 6-10 points of cowsheds, and there is the possibility of GPS error and improved position accuracy for zoning.

1. Global Positioning System Analysis

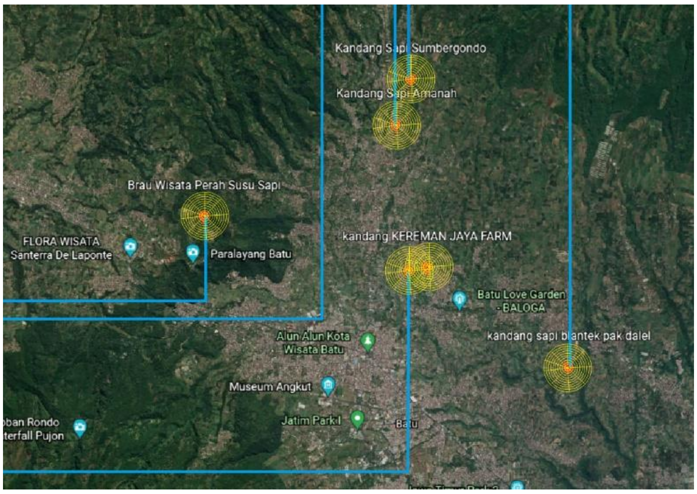


Figure 10. Position of cowsheds in Bumiaji Sub-district

Figure 11. Bumiaji Region, Batu, East Java

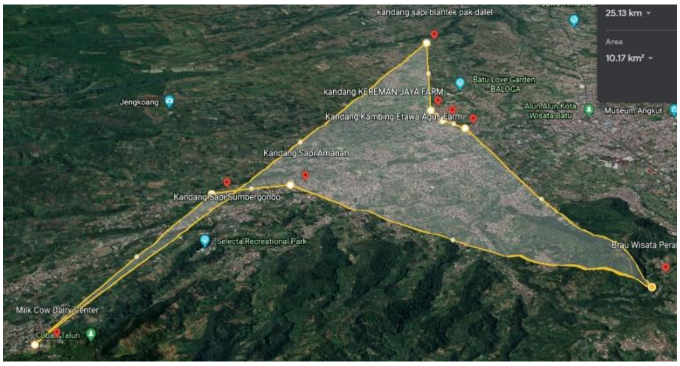


Figure 12. Distance between cattle farms in Bumiaji 3D

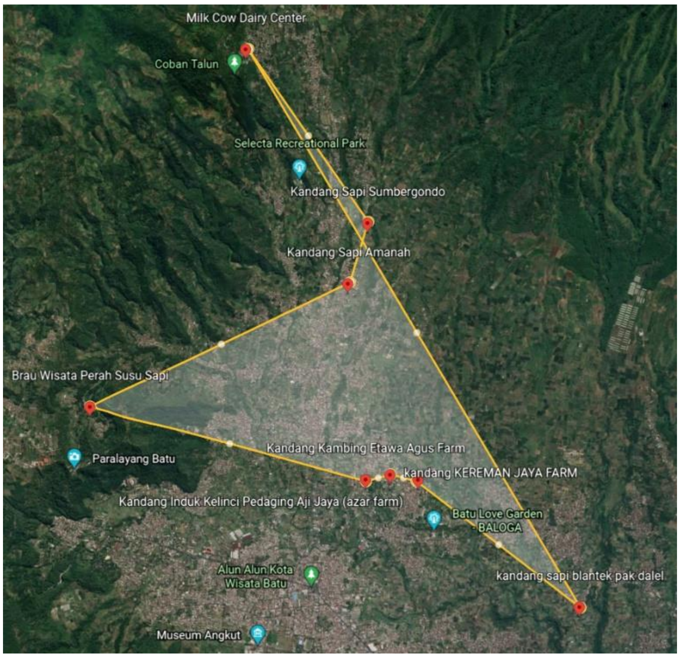


Figure 13. Distance between cattle farms in Bumiaji

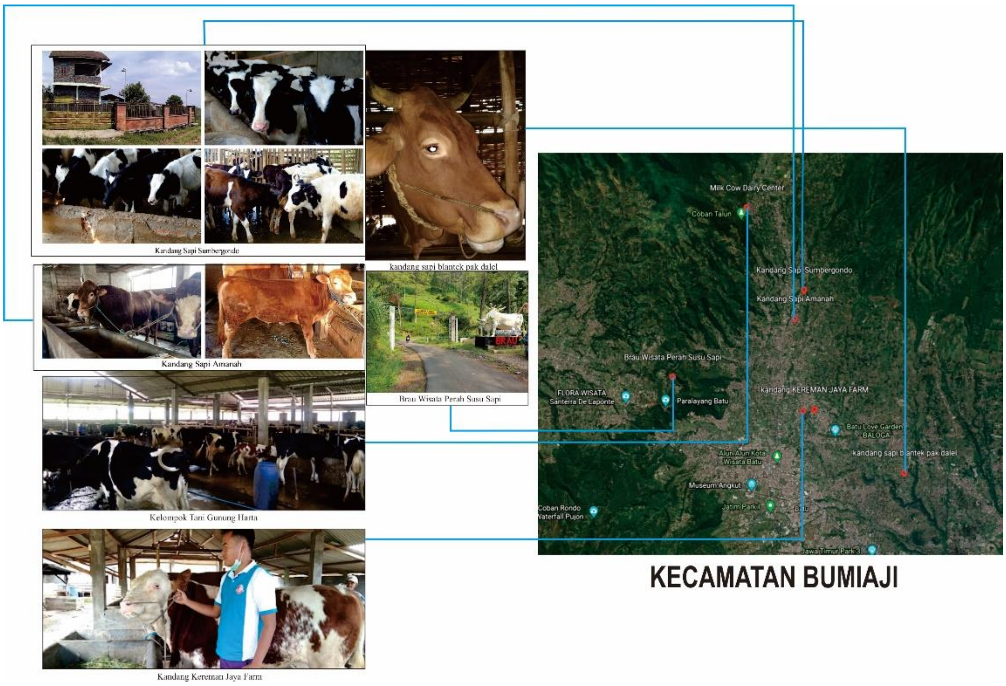


Figure 14. The position of the cowshed in the Bumiaji sub-district

The purpose of the GPS and cowshed analysis is to the effects of environmental pollution that could occur from cowsheds and surrounding residential points, radius, and also the possibility of the impact of water or sewer pollution that could occur from the leakage of cowshed sewers in *Bumiaji* with areas or points around it. With analysis development techniques, for example, using Python or AI in general, it can break down and produce an analysis of what percentage of environmental damage is on the water quality side. For example, the pH of water is no longer normal. So, it is necessary to add essential new data in detail, as shown in Figures 15, 16, and 17.

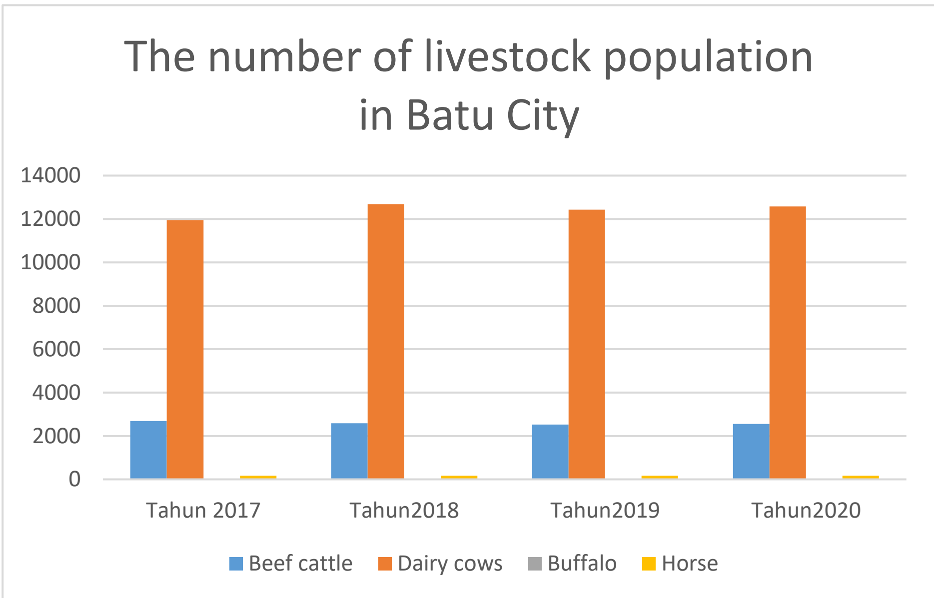


Figure 15. The number of livestock population in Batu City

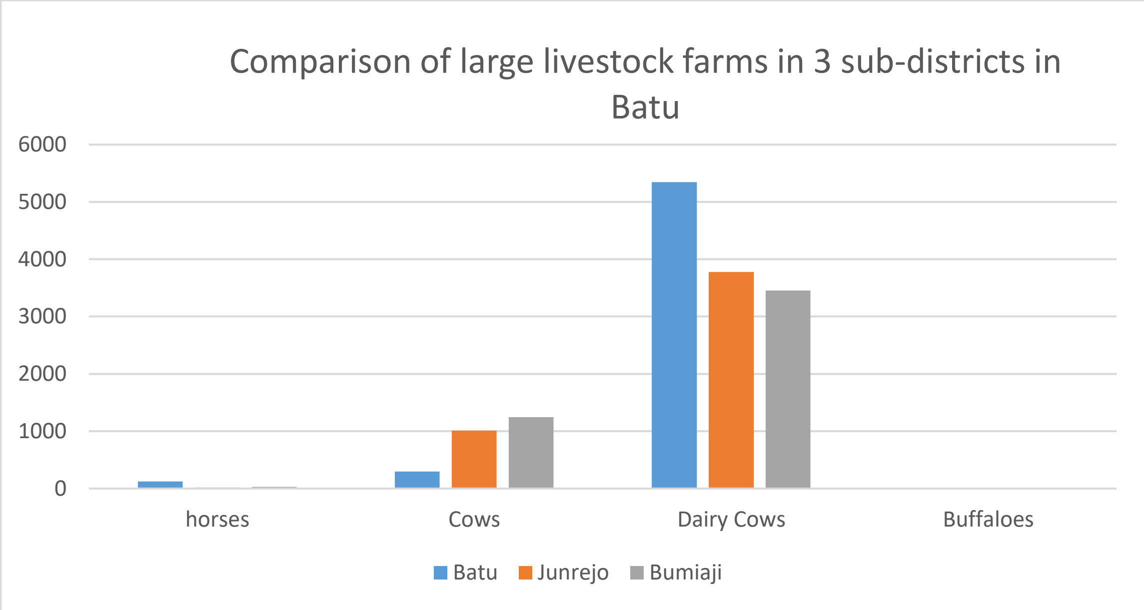


Figure 16. The Comparison of large livestock farms in 3 sub-districts in Batu – east java

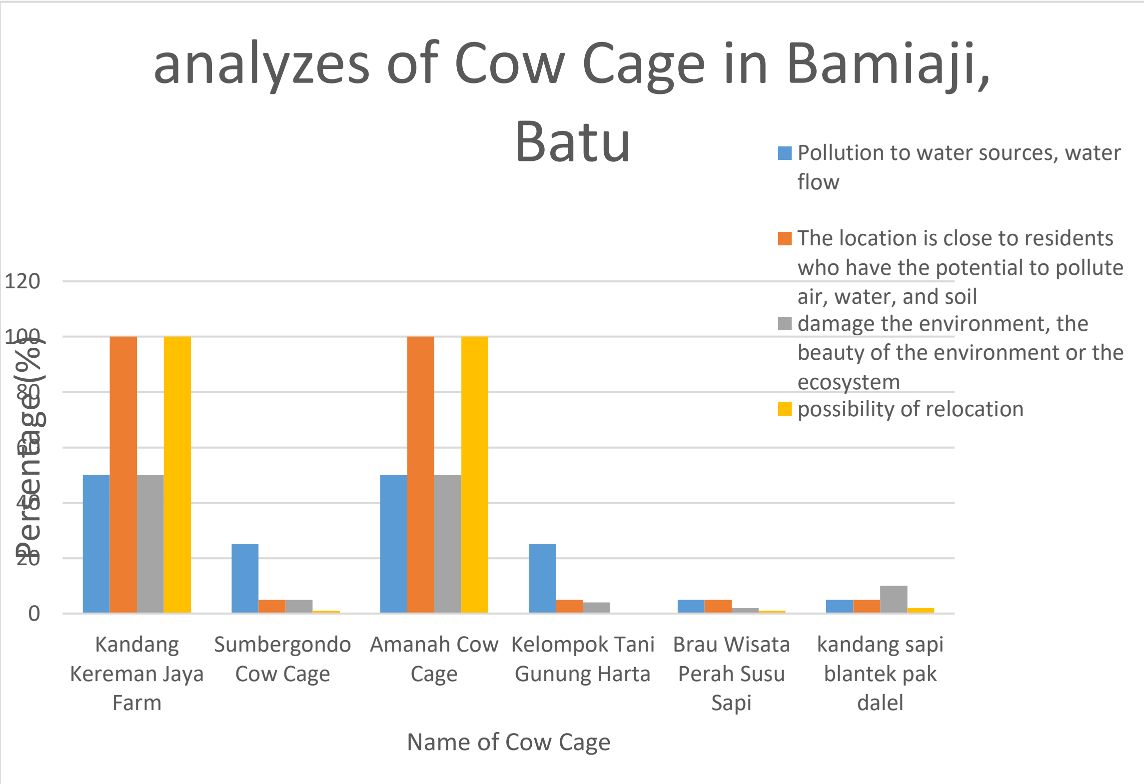


Figure 17. Graph analysis Estimates from the analysis of parameters on the state of the cattle farm in *bumiaji*

2. Water pH data collection and SIPALIT software analysis

Information retrieval via GPS is insufficient without testing the actual pH condition of the water in the cage area. This is to determine the exact value of pollution that occurs. Real-time water pH testing from several points is shown in Figures 18 and 19.

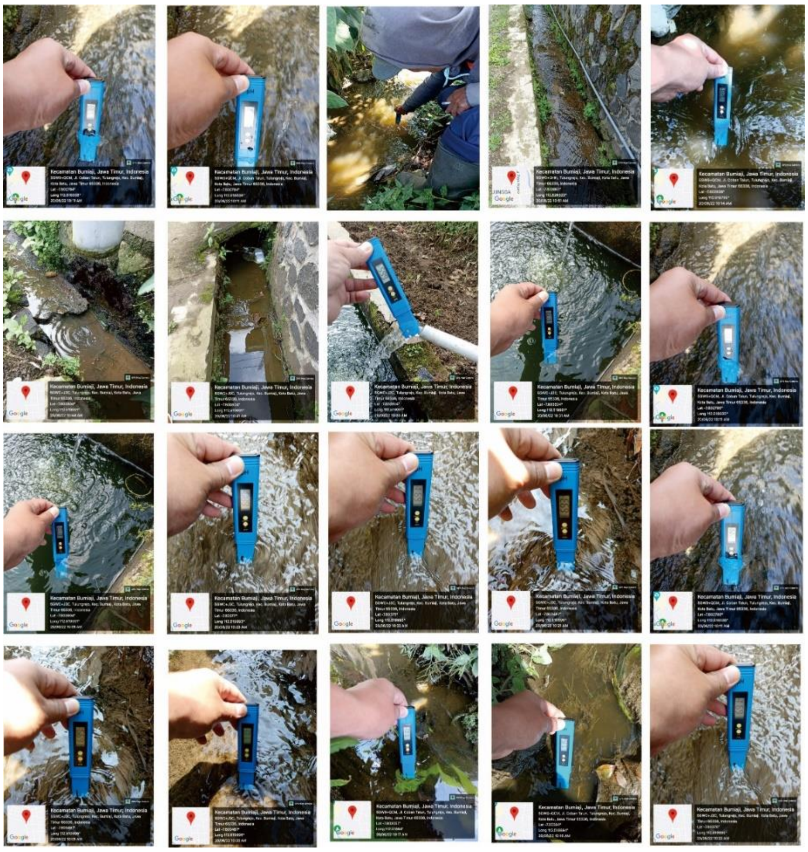


Figure 18. Sampling the pH of the water around Tulungrejo Cage

Figure 19. Water pH Testing Area

Figure 20. Satellite view: Channel data that is expected to provide point-by-point pH data

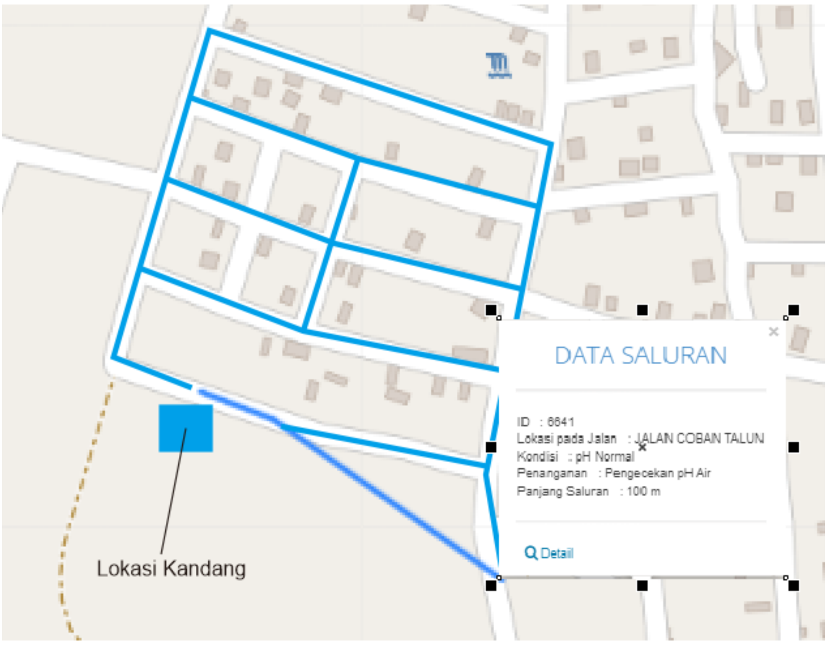


Figure 21. Street View: Data Channel that is expected to provide point-by-point pH data

The results of the water pH data will be added in real-time to the application built in this research, and the suitability of the map and water pH data at each point is the right data to be analyzed, as shown in Figure 20 and 21.

3. Results of Area Characterization Design of Communal Cages

Prevention of sewer leakage for cowsheds needs to go beyond monitoring and how to deal with it in the environment, but it needs to start with the design of a proper sewer. This chapter discusses designs that have been successfully made to create a proper shed.

Figure 22. Traditional Cage or Original Research Location

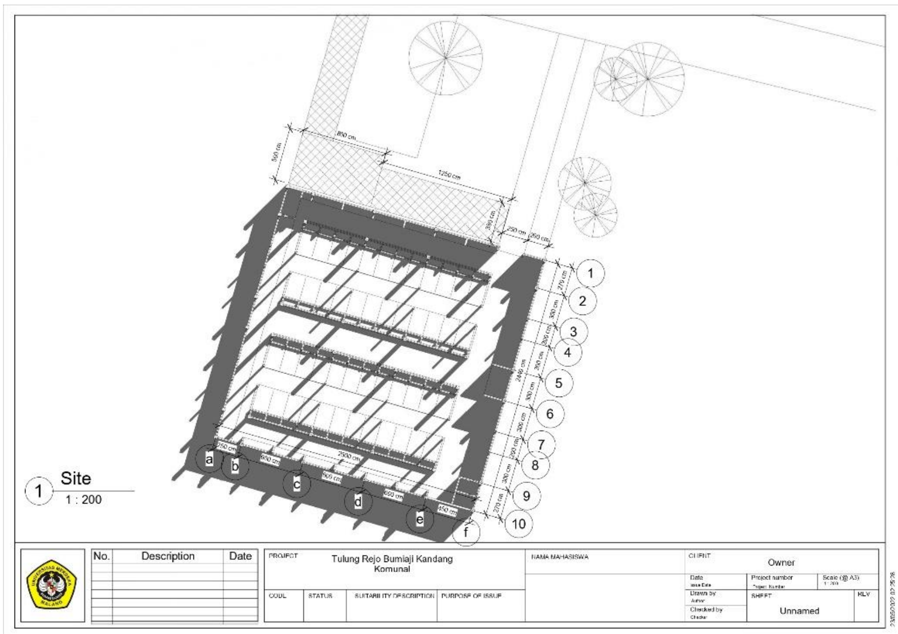


Figure 23. *Gunung Harta* Communal Cage

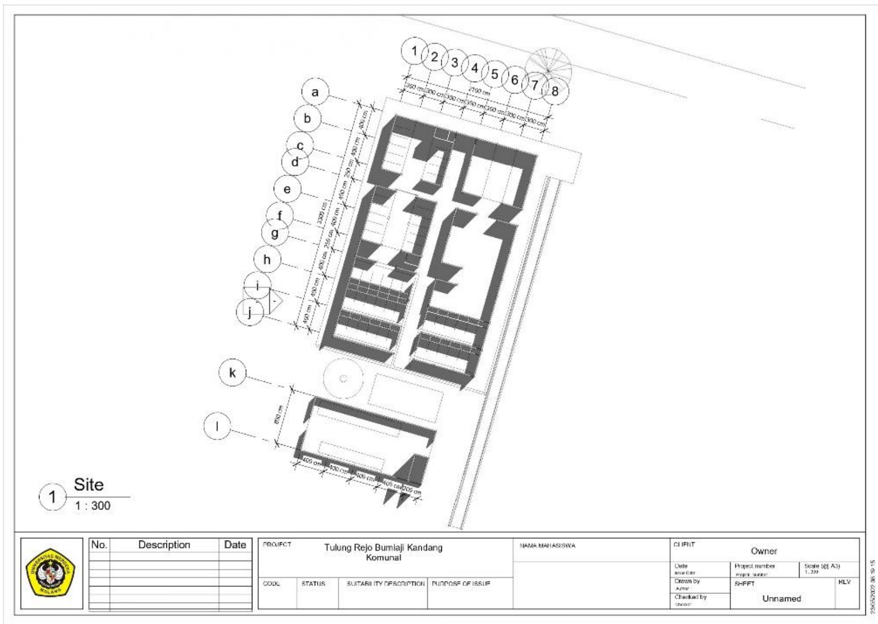


Figure 24. LMDH Communal Cage

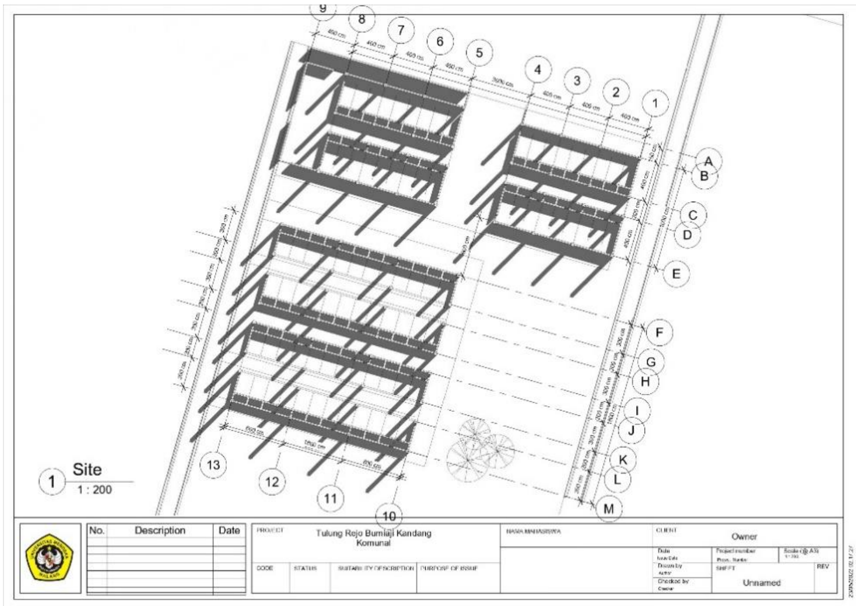


Figure 25. *Wonorejeki* Communal Cage

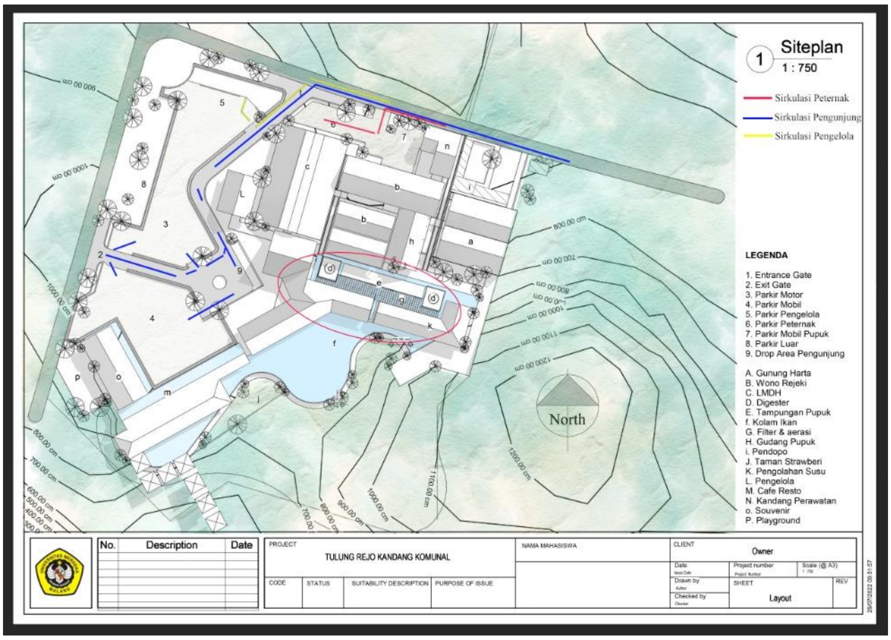


Figure 26. *Integrated WWTP Site Planning Plan*

The development is shown in Figure 26; WWTPs in communal housing areas are efficient when localized in one place, as shown in Figure 26 in the red circle. An integrated WWTP makes waste treatment more efficient and saves space. Design with a radius approach to the level of water pollution in the area around the cage is essential to see if there is pollution and the level of pollution. From this design, it can be seen that SIPALIT Software completes the level of pollution with a measure of water pH.

Figure 27. Design with a radius approach to see the level or level of water pollution in the population area around the cage

4. Analysis results on SIPALIT software.

The water pH collection data shown in Figure 18 is the basis for the SIPALIT Software analysis data entry, which is shown step-by-step in Figures 28, 29, 30, 31, 32, and 33.

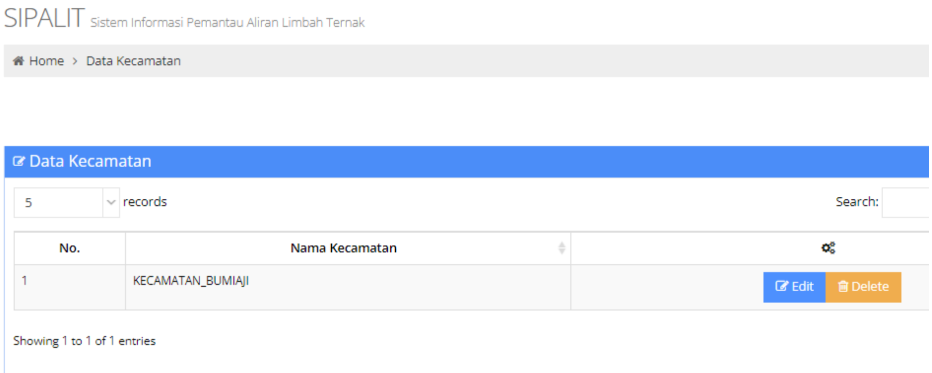


Figure 28. *Specify the Sub-district Location in the SIPALIT Application which is Bumiaji*

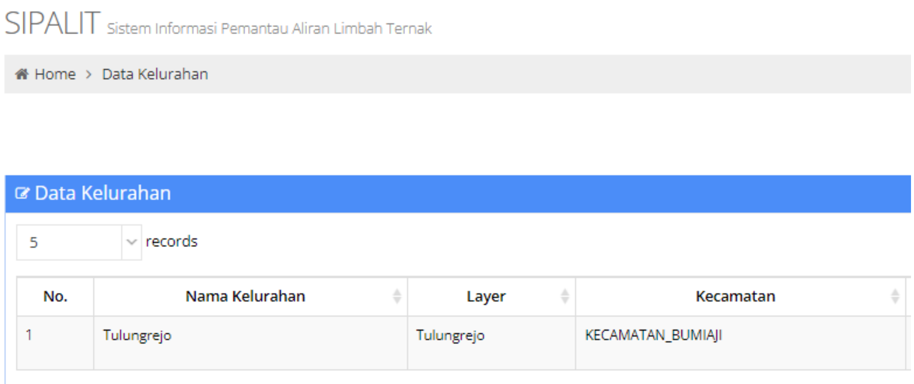


Figure 29. Determine the location of the Kelurahan in the SIPALIT application Tulungrejo

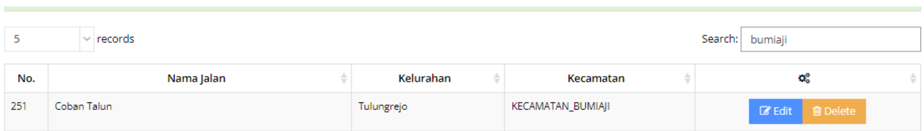


Figure 30. Determine the location of the road in the SIPALIT Application, namely Coban Talun Road

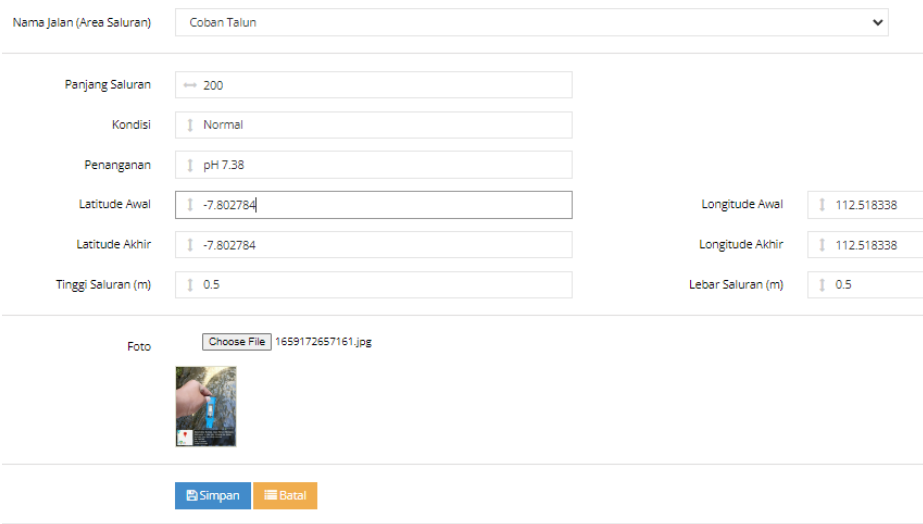


Figure 31. Input the pH condition of the water at each point

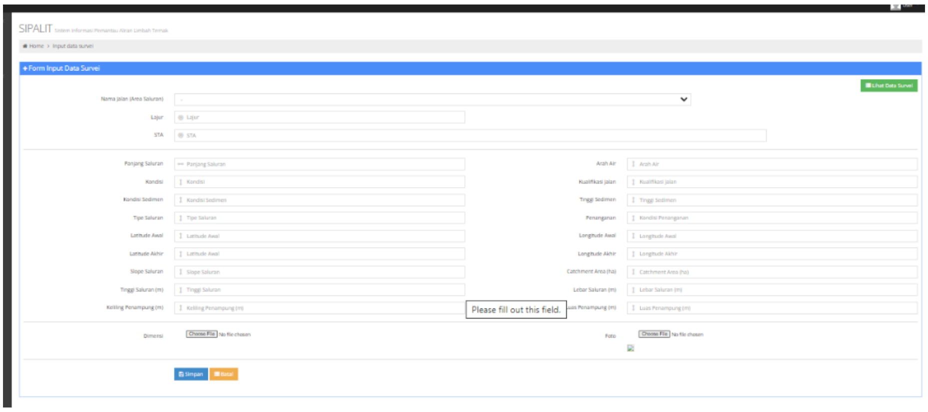
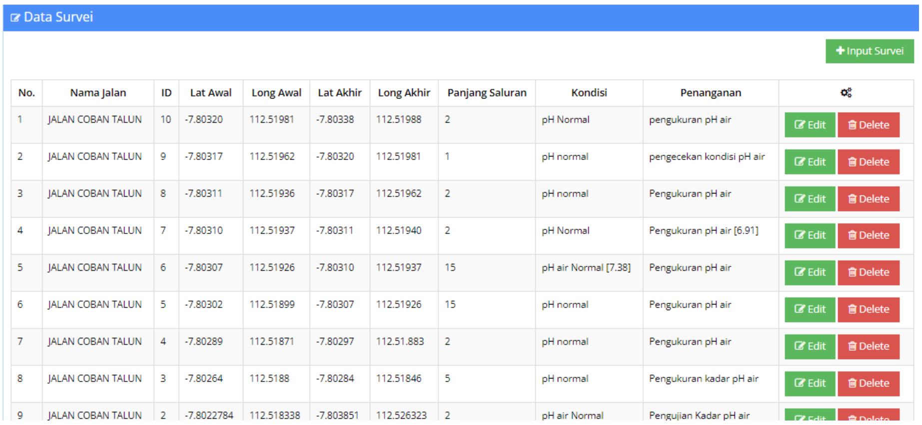


Figure 32. Specific survey input under water flow conditions



Data Survei

Input Survei

No.	Nama Jalan	ID	Lat Awal	Long Awal	Lat Akhir	Long Akhir	Panjang Saluran	Kondisi	Penanganan	
1	JALAN COBAN TALUN	10	-7.80320	112.51981	-7.80338	112.51988	2	pH Normal	pengukuran pH air	Edit Delete
2	JALAN COBAN TALUN	9	-7.80317	112.51962	-7.80320	112.51981	1	pH normal	pengecekan kondisi pH air	Edit Delete
3	JALAN COBAN TALUN	8	-7.80311	112.51936	-7.80317	112.51962	2	pH normal	Pengukuran pH air	Edit Delete
4	JALAN COBAN TALUN	7	-7.80310	112.51937	-7.80311	112.51940	2	pH Normal	Pengukuran pH air [6.91]	Edit Delete
5	JALAN COBAN TALUN	6	-7.80307	112.51926	-7.80310	112.51937	15	pH air Normal [7.38]	Pengukuran pH air	Edit Delete
6	JALAN COBAN TALUN	5	-7.80302	112.51899	-7.80307	112.51926	15	pH normal	Pengukuran pH air	Edit Delete
7	JALAN COBAN TALUN	4	-7.80289	112.51871	-7.80297	112.51.883	2	pH normal	Pengukuran pH air	Edit Delete
8	JALAN COBAN TALUN	3	-7.80264	112.5188	-7.80284	112.51846	5	pH normal	Pengukuran kadar pH air	Edit Delete
9	JALAN COBAN TALUN	2	-7.8022784	112.518338	-7.803851	112.526323	2	pH air Normal	Pengujian Kadar pH air	

Figure 33. Example Data in Sipalit for the area of Coban Talun street

5. Conclusions

Some farm locations are close to residents and must be relocated from existing data point locations. Farming is a Kereman cow cage and Amanah cow cage. This means that cattle farms located in areas close to residential areas need to be relocated because of the possibility of polluting water and air and damaging the beauty of the environment. The level of accuracy in solving the problem of environmental pollution due to cattle farming in Bumiaji, Batu, is determined from the results of the following parameter analysis:

Water pollution, level of air pollution due to position in densely populated settlements, Cattle farming that affects soil quality, Cattle farming that detracts from the beauty of the area, Cattle farming that causes other social problems (interfering with transportation access and other problems), Viewed from a distance between the farm area, streams and rivers, Analyzed the highest possible level of contamination from the 6 point, Possible Relocation and improvement of sanitation, Relocation if it is in a residential area or the distance is too close to residents, and Sanitation improvement in case of possibility of polluting rivers and other watercourses.

The management of communal cages in Wonorejo Hamlet, Tulungrejo Village, Bumiaji Subdistrict is very suitable to be managed in an integrated manner and used as an agro-tourism object with a spatial design and layout of WWTP and more efficient waste management. The alternative design is used as a second priority when the first design faces some obstacles; for example, it turns out that environmental pollution factors can occur because the pH of the water or water conditions are not normal. Another factor was the close proximity between the stable and the residential area, so it could be relocated in the future.

As an approach towards Green Ranch, waste management and the realization of a tourist visit area can be done with the design settings chosen in this research. The next step is the application and dissemination to the community.

Furthermore, SIPALIT Software has been proven to provide specific data using GPS technology. Data can be accurate if the location of the Latitude and Longitude points is correct. This software provides data in the form of real or real conditions on the flow of water in the area around the cage. Sipalit software plays a big role as a real information media and helps all groups or parties who want to find specific data about real conditions in the cage location area. Data or parameters that can be provided are water pH data. Water pH is an important parameter to determine whether or not water conditions are acidic, normal, or alkaline and whether or not waste from farms on Coban Talun Road, Tulungrejo, Bumiaji, Batu City, East Java.

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