# Development of GPS Track and Trace System in Dewantara Smart City Application to Realise Mobile-based Good Governance and Clean Government

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**Abstract.** Smart cities with GPS track and trace implementation have great potential to achieve good and clean governance. This technology enables the government to gather and analyse real-time data concerning mobility, public assets, and the allocation of funds. With precise and transparent information, the government can enhance efficiency, accountability, and responsiveness to the needs of the public. The primary goals of this application are to promote transparency, improve the management of community activities, and encourage community engagement. The approach employed in the creation and development of this smart city application follows the waterfall method. This methodology simplifies the system's initial development and its potential for future enhancements. The results from implementing and testing the smart city system, utilizing usability testing, yield scores exceeding 3, specifically 3.56. This indicates that both government officials and the community find the system and application highly user-friendly.

**Keywords:** Smart City, Track and Trace, GPS, Good Governance, Clean Government.

## 1 Introduction

Technological development is a process of evolution and innovation in various fields of science and technology that occurs over time. Technology continues to develop rapidly and undergo significant changes, shaping the way we live, work, and interact. Information technology is closely related to data processing into information and will look at how the distribution process is within a certain limit and time [1]. The development of Location-Based GPS for Track n Trace in Dewantara's Mobile-based Smart City application is an interesting and relevant project to improve efficiency and security in urban environments. In this scenario, GPS (Global Positioning System) technology will play a pivotal role in obtaining precise location data from the user's mobile device. The GPS receiver within each satellite utilizes signals transmitted by multiple satellites. By triangulating signals from at least three different satellites, the GPS receiver can compute the fixed position of a point, determining both its latitude and longitude. The concept of Smart City entails the development of a city that leverages information and communication technology to enhance efficiency, connectivity, and services for its residents. The ultimate objective is to enhance the residents' quality of life, optimize resource utilization, and mitigate adverse environmental impacts. A Smart City is essentially a city designed with the goal of benefiting society, particularly by efficiently and effectively managing resources [2].

Dewantara Sub-district of North Aceh is a sub-district in North Aceh District with a total population of 51,285 people [3], an area of 39.47 km2, and consists of 15 villages. The Dewantara Sub-district in North Aceh is experiencing significant economic growth. In this region, you can find several critical national projects, such as the Pupuk Iskandar Muda (PIM) factory and Malikussaleh University, which is based in the capital town of Krueng Geukuh.

A crucial facet of the Smart City concept revolves around mobility and transportation. An efficient and well-managed transportation system can enhance the mobility of citizens while reducing congestion. Therefore, there is a need for the development of a GPS-based mobile application aimed at tracking and monitoring economic activities and citizen transportation within the Dewantara District of North Aceh. Several key reasons justify the

creation of a GPS Track and Trace System for the mobile-based Smart City application in Dewantara. One of these reasons is the comparatively limited budgets that sub-districts typically have in comparison to higher levels of government. Implementing a Smart City necessitates substantial investments in technology infrastructure and application development. Additionally, challenges include relatively low levels of technology awareness and a lack of comprehension regarding the advantages and potential of Smart City applications. To address these issues, it is imperative to conduct educational and awareness campaigns aimed at informing both the public and government officials about the benefits associated with Smart City initiatives. To address these issues, collaboration between the government, the community, and the private sector may be required. Local governments can seek support and assistance from outside parties to build technology infrastructure and application development. Meanwhile, participatory approaches and educational campaigns can raise public awareness about the benefits of Smart City and increase their participation in the implementation of the programme.

When looking at these problems, a smart city system application is needed to answer the problems that exist in Dewantara District, North Aceh. as for the purpose of making smart city applications in Dewantara District, North Aceh, namely this application can help the District to improve public services and make the Dewantara District, North Aceh, a Good Governance and Clean Governtment area. The limitations in building a track and trace GPS-based smart city system in Dewantara District, North Aceh are:

a. The system built will focus on the entire area of Dewantara District, North Aceh.
b. The Smart city system will focus on improving community public services, community complaints, potential in each village in Dewantara District North Aceh, and monitoring for the agricultural sector, as well as transportation in the Dewantara District North Aceh area.
c. The smart city system uses GPS technology to monitor the movement of public services in realtime and accurately.
d. The application will be developed on the android platform
e. System focuses on the apparatus throughout Dewantara Sub-district of North Aceh, the community, and business actors both UMKM and farmers.

## 2 Research Methods

In developing a smart city system with GPS track and trace in realising Good Governance and Clean Government, the method that researchers use is the waterfall method. The reason for using this method is because the work on the system project to be built can be scheduled properly and easily controlled. The waterfall method also takes a systematic and sequential approach in building an application system [4].
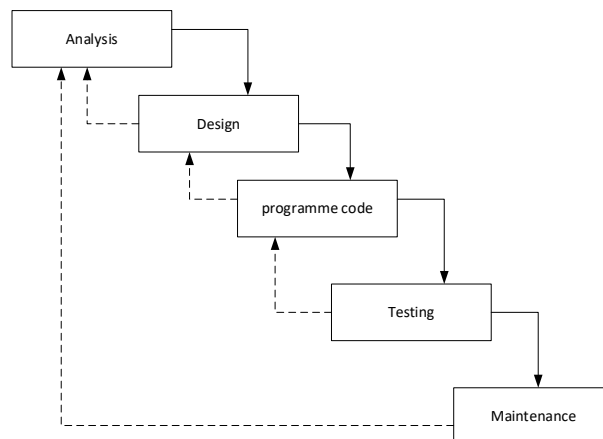


**Figure 1.** System Development Methods

### 2.1 Analysis

The analysis stage is where development must know and understand how smart cities are needed. At this stage, several data collection methods are carried out such as:

a. Interview
b. Observation
c. Survey

At this stage, several analyses of the needs desired by the North Aceh Dewantara District in building a smart city were obtained. Analysis of system requirements such as:

a. A smart city system application is needed for controlling UMKM activities, agriculture and the economy to see the progress of community income in Dewantara District, North Aceh.
b. This smart city application will later display Location Based from actions on community complaints so that it knows the track and trace of community complaint activities.
c. The smart city application will display the potential of the area in Dewantara District North Aceh both from the economic, agricultural and tourism sectors, considering that Dewantara District North Aceh has a fishing ground.

Hardware analysis such as:
a. The system will be made in the form of an android-based mobile application.
b. System for web-based government officials as smart city application control management.

## 2.2 Design

Information about requirement specifications from the Requirement Analysis stage is then analysed at this stage and then implemented in the development design. The design of the design is carried out with the aim of helping to provide a complete picture of what must be done. In this case the smart city system design will be seen in the Use Case. Use cases explain about the relationship between system with actors [5].
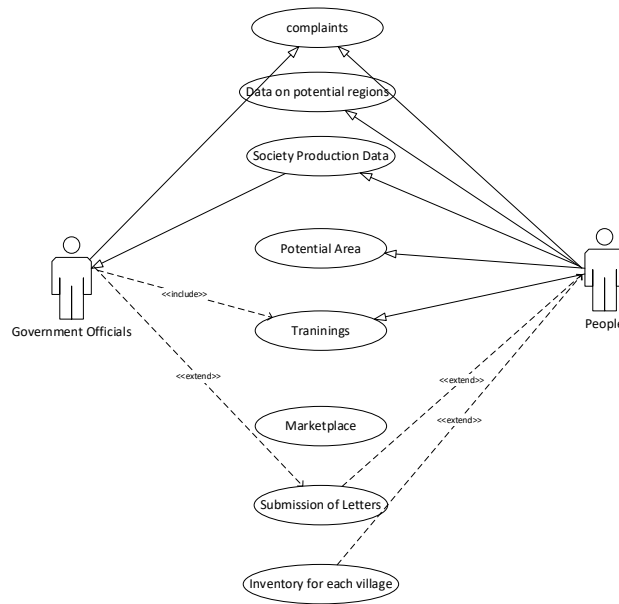


**Figure 2.** Use Case Smart City

## 2.3 Programme Code

The implementation and unit testing stage is the programming stage. Software creation is divided into small modules that will be combined in the next stage. The module stages in this smart city are:
a. Community Complaint Module
b. Village Potential Module
c. UMKM module
d. Village Inventory Module
e. Village APBG module
f. Letter Submission Module from Village to Sub-district
g. Track and Trace complaints in the form of GPS
h. Training module for the community in improving the economy of Dewantara Sub-district, North Aceh.

Programming language in making the system will use programming languages such as :
a. Mobile flutter 3.10. built in the form of an android operating system
b. MySQL
c. PHP Version 8
d. API Rest with Golang
e. Web Server with Golang

## 2.4 Testing

After all units or modules developed and tested in the implementation stage are then integrated into the system as a whole. After the integration process is complete, the overall system is checked and tested to identify possible system failures and errors. After all units or modules developed and tested in the implementation stage are then integrated into the system as a whole. After the integration process is complete, the overall system is checked and tested to identify possible system failures and errors. The testing method is carried out to check whether the application is in accordance with the expected requirements or not. The tester will monitor and assess the performance of the programme, whether the programme is working properly, or the programme still has errors when run. Later, the monitoring results obtained during the testing process by the tester will be used to conduct an evaluation. The type of testing used for this smart city application is usability testing. The Usability Testing method uses questions that are divided based on several categories, namely Learnability, Efficiency, Memorability, Errors, and Satisfaction and consists of 20 questions [6]. Usability Testing is a method that serves to evaluate the UX (user experience) of software, websites, or products made by testing several users or consumers[7].

## 2.5. Maintenance

Maintenance management system is a computerised system to plan, monitor, assess and optimise all maintenance activities in one centralised system. Maintenance tasks can be carried out according to a schedule and thoroughly so that the performance of the machine can be maintained and can increase profits Districts [8].

# 3 Results and Discussion

In the application of smart city applications, the smart city system will be divided into two parts:
a. The section for government officials in Dewantara Sub-district, North Aceh and villages around the sub-district is web-based.
b. The whole community in Dewantara District of North Aceh is mobile based with the Android operating system
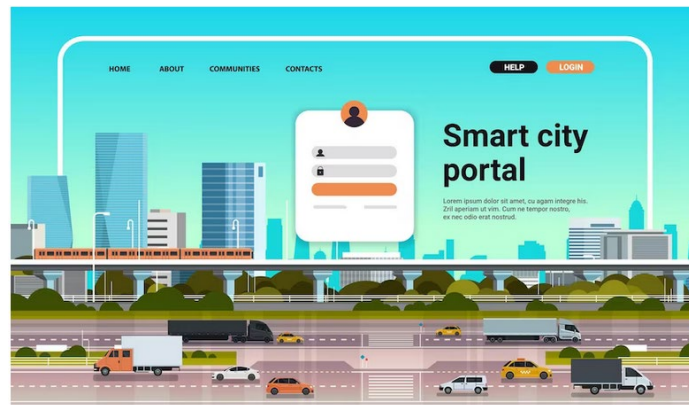
## 3.1 Smart City Portal



**Figure 3.** Smart city Portal

The Smart City Portal serves as an information centre for citizens and visitors to access various information related to the villages in Dewantara Sub-district, North Aceh. The portal can be a tool to encourage active citizen participation in city life. Citizens can provide feedback, make suggestions, or report problems through this portal. Smart city portal is a system for system management in controlling smart city applications that will later be used by the community around Dewantara sub-district, North Aceh. Smart City portal as a web-based system in the smart city application in monitoring all Dewantara smart city application activities such as track and trace monitoring in reviewing community complaints according to the location set in the Dewantara Smart city mobile application Users of the smart city portal, such as :
a. Village apparatus
b. Sub-district government
The features contained in the Dewantara Portal smart city, namely:
a. The portal system has realtime tracking of village assets and village budgets.

b.  The portal system monitors the follow-up of complaints, projects in the village of Dewantara Sub-district, North Aceh.
c.  The portal system will provide features in the form of transparency of village funds and budgets in the Dewantara District of North Aceh.
d.  The portal system can see the real-time location of complaints given by the community from the mobile-based Smart Dewantara application.
e.  The portal system provides solutions, input and direction for the community in supporting and improving economic activities in Dewantara District.
f.  The portal system can receive incoming letters from the community quickly and accurately, such as permits and others.
g.  The portal system will be able to monitor developments in villages around the Dewantara District area in North Aceh.
h.  The portal system will provide notifications for rapid emergency response in the event of a disaster, whether natural or other
i.  The portal system can detect patterns in the flow of budget funds in each village.

In achieving maximum results from the Smart Dewantara features above, the Smart Dewantara system and application must have a reliable level of system security in data security and privacy of community data in Dewantara District, North Aceh. So that this system will later be strengthened with system security technology in applications and web-based systems with system security algorithms. The use of system security algorithms makes the protection of personal data and clear user policies safe and secure.

## 3.2 Smart City Mobile Application

The mobile-based Smart Dewantara application will be used by the community. This application will be built with the Android operating system using Flutter 3.10. In supporting the Track and trace GPS-based Smart Dewantara application in achieving Good Governance and Clean Government in Dewantara Sub-district, the Smart Dewantara application has features such as:

a.  Marketplace, used as a buying and selling feature for the community in Dewantara District, North Aceh in supporting the economic level in Dewantara District, North Aceh. This feature will later be equipped with an application that is connected to other applications, namely as a complementary application for the delivery of buying and selling that will be used by truck drivers, and becak.
b.  Quick response complaints, in this feature the community can provide complaints or problems that occur in the Dewantara area by specifying the location points that need to be addressed, complaints and photos or videos.
c.  GPS track and trace feature, this feature is a realtime tracking system for complaints that have been inputted by the community. This feature will show the position of the handling officer and track the extent to which it has been handled by the Dewantara District government in North Aceh.
d.  Financial features, the community can see the flow of budget funds in the Village and District Dewantara North Aceh.
e.  News, a feature as news about the North Aceh Dewantara Sub-district area.
f.  Submission, this feature is for community submissions that require certificates from Dewantara Sub-district, North Aceh.
g.  Potential, this feature will show potential areas in agriculture, tourism, livestock and fisheries.
h.  Training and certification, in this feature the community can see training activities for youth, MSMEs, farmers and fishermen to obtain training certificates according to their fields.
i.  Job seeker, This feature will give you information about work around the area of the council's fault zone
j.  School, This feature shows the schools that exist in the council of north a day.

By looking at these features and using track and trace GPS features will provide accurate and real time information. The application smart dewantara' can increase community participation with the government, so that it can contribute positive to the achievements of good government and faulty government area.
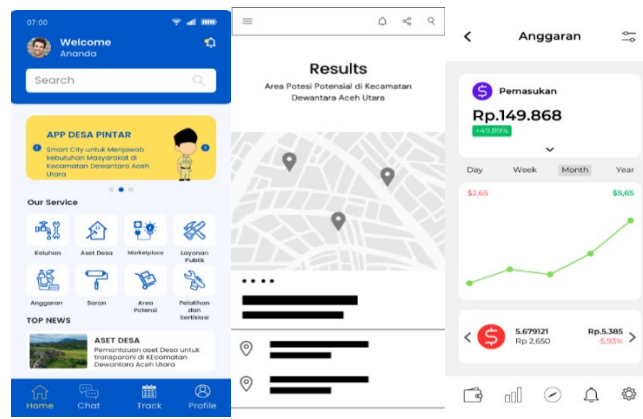
**Figure 4.** Smart City Application Mobile

## 3.3 Testing

For system testing using usability testing. Usability testing will use several tasks in testing users of the smart city system in Dewantara Subdistrict, both to government officials, village officials and the community. Usability is a product that can be used by certain users to achieve set targets with effectiveness, efficiency and achieve user satisfaction in a particular context effectiveness, efficiency and achieve usage satisfaction in a particular context [9]. Tasks in usability testing will be given to 100 respondents consisting of government officials in Dewantara District, North Aceh, Village Heads, people who will use smart city applications. Tasks are created as a means of facilitating usability measurement.

**Table 1.** Task-Task Usability Testing

| No | Task |
|---|---|
| 1 | Log in to the system as the user, then log out and log back in |
| 2 | Making complaints and responses to complaints |
| 3 | Viewing each village's budget and village assets and in the Sub-district |
| 4 | Inputting public services such as making a certificate from the sub-district, or people's aspirations |
| 5 | View the track and trace of complaints that have been inputted in the form of a map in real time |
| 6 | Marketplace's Village |

The aspects of usability testing include five things, namely:

a. Learnability, explaining the level of ease of users or users to complete basic tasks when they first see or face complete basic tasks when they first see or deal with the system
b. Efficiency, explains how quickly users can complete tasks when they first learn the system.
c. Memorability, explains the level of ease of users or users in using the system well, after some time not using it.
d. Errors, describes the possibility of errors or errors made by users and how easily they can overcome them.
e. Satisfaction, describes the level of user satisfaction in using the system that has been created.

The results of the plot of the five usability aspects above against 8 questionnaire questions can be seen in Table 2.

**Table 2.** Usability Value Result

| No | Questions | Value |
|---|---|---|
| 1 | What the smart city display and system user friendly? | 3,62 |
| 2 | What the System is easy to use ? | 3,52 |
| 3 | What Applications and systems have an eye-catching interface design ? | 3,72 |
| 4 | Are the menus easy to recognise and easy to operate? | 3,82 |
| 5 | Are the pages easy to search ? | 3, 62 |
| 6 | Are the symbols in the system and application easy to read? | 3,52 |
| 7 | What is the ease of accessing information from the menu? | 3,65 |
| 8 | Is there access to the track and trace menu to see the progress of community complaints? | 3,78 |

Table 2 shows the values of user satisfaction or acceptance of each attribute. It can be seen that for the attribute "Ease of recognising the android interface" has a usability acceptance value by the user of 3.56 (already above the value of 3 or above the middle value) on a scale of 5. This can be interpreted that the smart city system that has been made is easily recognised by the user from the interface page to the system process.

## 4  Conclusion

In conclusion, implementing smart cities with GPS track and trace technology can contribute positively to Good Governance and Clean Government. Here are some reasons why this technology can help achieve these goals:

a. Transparency and Accountability: Through GPS track and trace systems, governments can monitor in real-time various aspects such as the use of public funds, project implementation, and the mobility of officials. By having timely and accurate data, the government can be more transparent in its actions and decisions and improve accountability.
b. Corruption Reduction: GPS track and trace technology can help in preventing and reducing corruption. Data collected from tracking public vehicles and assets can help detect suspicious patterns, such as improper use of funds or other corrupt behaviour.
c. Operational Efficiency: By utilising this technology, governments can improve efficiency in infrastructure and resource management. Timely information on traffic, mobility patterns, and energy usage can help in better planning and decision-making.
d. Responsiveness to Public Needs: GPS track and trace systems allow the government to better understand the needs and expectations of the people. The data collected can be used to design more relevant and citizen-focused policies and programmes.
e. Performance Monitoring and Evaluation: This technology enables the government to conduct monitoring and evaluation of public sector performance. With better monitoring, the government can identify problems that may arise and take immediate corrective action.

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