Internet of Things for Smart Transportation in North Moluccas Province

Imam Hizbullah\textsuperscript{1,2,3}, Fahrizal Djohar\textsuperscript{2}, Zulaeha Mabud\textsuperscript{3}

\textsuperscript{1,2,3} Department of Electrical Engineering, Faculty of Engineering, Universitas Khairun

Abstract. The Internet of things is a service that supports the realization of the smart city concept. Connectivity between computer devices and computers with sensors connected to the Internet supports community activities that improve the quality of life. Smart transportation is part of the smart city concept that focuses on an efficient transportation control system. The mobility of the people of the northern Maluku province is very dependent on land and marine transportation modes due to the geographical condition of the province, which is in the form of an archipelago. The safety and efficiency of marine transportation is still a topic that needs attention today. This paper proposes an IoT-based smart transportation model that focuses on marine transportation. Machine-to-machine (M2M) protocol, telecommunications technology, and cloud computing play an essential role in this research.

Keywords: Internet of Things, Smart City, Smart Transportation, North Moluccas.

1 Introduction

Water transportation is one of the most widely used modes of transportation for inter-island crossings, including in the province of North Maluku. Many users use water transportation to reach other islands because this transportation can only reach some destinations. Water transportation is used by users every day, starting from leaving for work in the morning until returning home in the afternoon, and not infrequently, some arrive at night. Several developments need to be done if you look at the system's current state. Starting from the payment system, which is still manual, to the order of the queue of ships that will load passengers, who are sometimes still confused for passengers who will use the services of the boat.

A smart and safe transportation system can be a development goal in an area with a dense population. Internet of things can help develop intelligent transportation systems using the machine-to-machine protocol IPv6 and other technologies such as 3G telecommunications technology or other IEEE standards. Sea transportation is an essential type of transportation in several countries, especially parts separated by the sea, by providing lower prices for access than other alternatives. When the number of users increases, access to facilities creates queues, and accidents occur when using this type of transportation—the causes of problems such as bad weather, excess passengers, and collisions. At the time of doing so, there are some limitations, such as the inefficiency of the telecommunication system. Improvements were made by proposing a system that could detect potentially dangerous situations and handle them to prevent unwanted situations [1].

The Internet of Things further contribute to developing one of the new technological paradigms, the Internet of Ships (IoS) which is the interconnectedness of maritime objects in an integrated network such as transportation and ports. The information contained in the system can be managed and accessed by users such as passengers, travel agents, to ship captains. This integrated system aims to improve security, route optimization, early detection of errors, tracking, and monitoring energy use for efficiency [2]. Integrated data management needs to be done with various information and communication technologies. The data obtained can be collected and processed into information that can be monitored; one of the implementations is by providing WiFi hotspots and video surveillance for smart ships for monitoring and alarm systems [3]. With the number of passengers increasing at certain times, a management system is needed to produce a safe and efficient transportation system. One of the mathematical models tested for developing such a system is Mixed Integer Nonlinear Programming (MINLP), which considers fuel consumption, vessel speed, scheduling system, and sea wave height indicators. Several algorithms that can be used for efficiency and smart systems, such as Nondominated sorting genetic algorithm II (NSGA-II) and multiobjective particle swarm optimization, were tested on large-sized instances, with results to pay attention to the desired profit and the resulting carbon emissions [4].

* Corresponding author: imam@unkhair.ac.id
The smart concept combines ICT and IoT to increase the efficiency of a city's services and connect several public services. Smart transportation integrates planning in realizing the smart city concept; of course, it becomes crucial in developing a smart city.

This paper is expected to be one of the studies that try to provide a solution for the sea transportation system in North Maluku so that the system becomes smarter. This smarter system can be developed using technology, such as the Internet of things. The planned Internet of things devices will focus on the marine transportation system. The development of smart transportation is also expected to be a supporter of the smart city concept, which is being developed for today's cities.

2 Research Methods

The researcher uses a literature study [5], starting by designing a review, conducting a review and analysis and writing down the results of the review. Perform the reference search process using the keywords “IoT Smart City”, “smart transportation”, and “IoT smart transportation”. Sources took from several journals published from 2016 – 2022. Furthermore, analysis and review of related research are carried out, most likely to be applied based on area conditions. The last stage is to propose an IoT device design for a Smart transportation system.

The researcher uses a literature study [5], starting by designing a review, conducting a review and analysis and writing down the results of the review. Perform the reference search process using the keywords “IoT Smart City”, “smart transportation”, and “IoT smart transportation”. Sources took from several journals published from 2016 – 2022. Furthermore, analysis and review of related research are carried out, most likely to be applied based on area conditions. The last stage is to propose an IoT device design for a Smart transportation system.

3 IoT Development

Several IoT developments are related to smart transportation systems, such as safety systems, environmental monitoring, passenger management systems, real-time transportation tracking, and energy efficiency.

A good security system is one of the important parameters in developing a smart marine transportation system. In previous years there were still accidents that occurred related to the use of this sea transportation. Therefore, it is necessary to design a system that can reduce the number of accidents that occur. Several methods are proposed to overcome this, such as automation of navigation systems, monitoring systems, and communication technology installed on boats that can detect and handle to make transportation safer and provide safety services during emergencies [2].

Environmental monitoring is carried out to support the development of a safer system with indicators such as weather, wind speed, rainfall, etc.[6]. The system can also be developed to make parking more gentle considering the position of the boat with other boats and the harbour. Connections between boats and ports can also be developed by considering environmental conditions resulting in a more effective communication system for this smart transportation system.

The current state of the passenger management system still needs to be developed. The manual passenger management system is still seen as less efficient and effective. Developments can be made to digitize existing systems, such as the payment system, which can be developed to be more efficient with fintech, as well as available boat information that can be integrated with the system to be known by captains, port officers, and passengers who will use the system. This transportation service. The system can also be developed with the aim of making the passenger loading process more secure and effective by paying attention to the arrangements or schedules of each boat, and passengers, alone or in groups, can also be arranged to board the boat according to the circumstances and capacity, thereby reducing port queues.

Transportation tracking can also be done in an integrated manner with a centralized system to provide information to information users [7]. The development is expected to be carried out in real-time so that it can determine the current position of the boat or when it is needed. This tracking system can also function if an unexpected situation occurs so that it can notify the security officers immediately; it can speed up the evacuation process in certain conditions.

The development that can be done is also in the energy efficiency section. The use of fuel can be efficiently regulated to be supplied to the engine used. The number of machines used can also be regulated by taking into account the conditions and needs of the planned time. The system is expected to become more efficient so as to protect the environment and provide more income to transportation providers with efficient use of fuel. The development is expected to be carried out in real-time so that it can determine the current position of the boat or when it is needed. This tracking system can also function if an unexpected situation occurs so that it can notify the security officers immediately. It can speed up the evacuation process in certain conditions.

The development that can be done is also in the energy efficiency section. The use of fuel can be efficiently regulated to be supplied to the engine used. The number of machines used can also be regulated by taking into account the conditions and needs of the planned time. The system is expected to become more efficient so as to protect the environment and provide more income to transportation providers with efficient use of fuel.

4 Discussion

In this section, we will describe the use of IoT to develop a smart marine transportation system in the province of North Maluku. IoT is designed to suit the current state and conditions in the area, considering the latest IoT
devices. The description of an integrated system that utilizes IoT is as follows.

![Fig 1. Integrated smart transportation system](image)

The system developed integrates several sub-systems such as safety systems, environmental monitoring, passenger management, real-time transportation tracking, and energy efficiency. Information obtained and collected from IoT technology is then processed and forwarded to information users such as captains, port offices, and passengers. Every user gets information according to his needs; a passenger may not get all the information but only what he needs, such as a safety passenger management system and real-time transportation tracking. Then, the system described above explains what IoT devices are planned to be used in the system. The description of the use of IoT devices is as follows.

![Fig 2. Internet of Things for Smart Transportation](image)

The picture above illustrates the use of IoT technology for smart transportation systems. IoT devices are used in each subsystem, such as GPS in the transportation tracking subsystem, CCTV cameras in the safety system, anemometer and rain sensors in environmental monitoring, and integrated smart cameras for passenger management.

5 Conclusion

This research was conducted to develop the existing transportation system in North Maluku Province. This primary research utilizes existing technological developments such as massively developed and used IoT devices, telecommunications technology, inter-machine protocols, and the use of cloud computing. Several subsystems were developed: safety system, environmental monitoring, passenger management system, real-time transportation tracking, and energy efficiency. The subsystem describes the types of IoT devices used to make an integrated smart transportation system more effective and efficient. Further research is needed to implement IoT devices in marine transportation systems in the north Moluccas.

References


