Integrated Web Server-Based Ticket Booking and Passenger Motorboat Positioning System with GPS GT08

Magfhirah Auladina Ratuloli[1], Nugroho Suharto[2*], Lis Diana Mustafa[3]

[1]Digital Telecommunication Network Study Program, Department of Electrical Engineering, State Polytechnic of Malang, 65141, Indonesia

[2,3]Telecommunication Engineering Study Program, Department of Electrical Engineering, State Polytechnic of Malang, 65141, Indonesia

[1]1941160006@polinema.ac.id , [2]nugroho.suharto@polinema.ac.id, [3]lis.diana@polinema.ac.id

***Abstract*— The main transportation used in the NTT region is sea transportation. Because sea transportation is the main transportation within the province, ships not only carry passengers but also transport vehicles and logistical needs. Until now, passenger motor ships have not been equipped with a ship navigation system, because these ships are still very traditional. There is no ship position information system and online ship ticket ordering, which makes it difficult for the public. Payment is usually made when crew members go around to give tickets. However, due to the large number of passengers due to the ship's limitations, the situation became less conducive and less safe. In fact, it often creates conditions because many passengers do not pay for ship tickets, causing losses to the owners. Based on the problems explained above, the aim of this research is to design a "Web Server Based GPS GT08 Integrated Passenger Motor Ship Position Information and Ticket Booking System", making it easier for people to order tickets online and reducing incidents of paying for ship tickets. Apart from that, both passengers and ship admins can see the current position of the ship.**

***Keywords*— *GPS Tracker, Ship, Ship Location, Ticket Booking, Web Server*.**

I. INTRODUCTION

Maritime transportation plays a crucial role in global trade and mobility, particularly in archipelagic countries like Indonesia. According to the Ministry of Transportation of Indonesia (2023), over 17,000 islands rely heavily on sea transport for economic and social activities. Despite its significance, many regions still face inefficiencies in ticketing systems and real-time vessel tracking, leading to delays, overcapacity, and safety concerns [1]. Traditional methods, which often involve manual ticket sales and non-digital record-keeping, increase the risk of data inaccuracy, unauthorized ticket reselling, and ineffective passenger management [2].

The advent of GPS-based tracking technologies and digital ticketing solutions has revolutionized various modes of transportation. In the airline and railway industries, the implementation of web-based booking systems has significantly improved operational efficiency and passenger convenience [3]. However, maritime transport, especially small-scale passenger ferries, has been slow in adopting such innovations. Studies indicate that a robust digital system integrating GPS tracking and web-based ticketing can optimize vessel operations and enhance passenger experience [4].

The issue of inefficient maritime transport systems is particularly pronounced in remote regions such as East Nusa Tenggara (NTT), where sea transport is the primary means of connectivity. Reports suggest that unreliable schedules, lack of digital ticketing, and absence of real-time vessel tracking have led to frequent delays and safety hazards [5]. In 2021 alone, several maritime incidents in Indonesia were attributed to overloading and lack of tracking mechanisms [6]. A GPS-based vessel monitoring and web-integrated ticketing system could significantly reduce such risks and improve overall service efficiency.

The proposed research focuses on developing an Integrated Web Server-Based Ticket Booking and Passenger Motorboat Positioning System with GPS GT08 for small motorized passenger boats. This innovation addresses critical challenges such as unregulated passenger flow, difficulty in monitoring real-time ship locations, and ineffective emergency response mechanisms [7]. By implementing this system, operators can monitor vessel movements accurately, reduce unauthorized ticket scalping, and provide passengers with a seamless digital booking experience [1].

The GPS GT08 module enables real-time vessel tracking, offering precise location data that can be accessed through a web-based interface. This system provides maritime authorities and operators with up-to-date information on vessel movements, enhancing navigation safety and operational transparency. The web-integrated ticketing system, on the other hand, allows passengers to book tickets online, reducing long queues at ports and preventing overbooking.

Moreover, real-time tracking contributes to enhanced maritime safety. Studies highlight that GPS-based monitoring significantly reduces navigation risks and improves coordination during emergencies [9]. A web-integrated system

*Corresponding author

also enables regulatory authorities to oversee vessel activities and enforce compliance with safety regulations [10]. In Indonesia, where ferry accidents remain a concern, deploying such systems could mitigate risks associated with overcrowding and unauthorized vessel departures [11].

Beyond safety and efficiency, digital ticketing fosters financial transparency. Maritime operators frequently encounter revenue leakage due to cash-based transactions and manual ticket issuance [12]. By adopting an automated web-based ticketing platform, ferry services can enhance financial reporting accuracy and optimize revenue management [13]. Additionally, passengers benefit from reduced waiting times and the convenience of securing tickets online, similar to advancements observed in the aviation and rail sectors [14].

Despite the apparent advantages, challenges in implementation persist, particularly in remote areas with limited digital infrastructure. Research by Hakim et al. (2022) emphasizes the importance of government support, investment in maritime technology, and stakeholder collaboration to ensure widespread adoption. In response, this study will evaluate the feasibility of integrating GPS GT08 tracking with a web server-based ticketing system, considering technical, financial, and regulatory aspects to enhance the sustainability of Indonesia's maritime transportation network [12].

Furthermore, implementing digital innovations in maritime transport aligns with Indonesia's Maritime Highway Program (Tol Laut), which aims to enhance inter-island connectivity and economic growth. The introduction of a GPS-integrated ticketing system supports the government's vision of modernizing maritime logistics and reducing inefficiencies in the passenger ferry sector [15]. This study will assess how such a system can contribute to Indonesia's broader digital transformation agenda while addressing the unique challenges faced by local ferry operators.

II. METHOD

The type of research used in this research is manufacturing/development research which starts from the design stages of preparing materials and equipment, determining parameters, implementing the design, up to the creation of tools, systems and applications that are suitable for use. This research involves tracking passenger motorboats based on a website that is integrated with the GT08 GPS device so that this research is a form of research in the field of information technology and transportation.

This research focuses on developing a system that utilizes GPS data from the GT08 device installed on a passenger motor ship. This system will track the movement of the ship, collecting location data, speed and other relevant information. GPS data processing techniques and data analysis are an important part of this research.

Another part of this research is the development of a website and user interface (UI) that allows users (Port operators), to track and monitor ship movements in real-time. This interface must be user-friendly, provide relevant information, and be accessible from various devices with an internet connection. This research also involves integration between the GT08 GPS device, tracking system, and website.

This involves understanding the communication protocols used by the GT08 device, processing of incoming data, and efficient data storage and retrieval. This research will cover the stages of implementing a tracking system on an actual passenger motor ship. These tests will help identify potential problems, validate tracking accuracy, and practically measure system performance. Data collected from ship tracking can be used for deeper analysis, such as understanding movement patterns, most efficient routes, or estimated arrival times. This data visualization can help make better decisions.

The research stages in developing this website-based information system begin with a literature study, where an in-depth analysis of the research background is conducted. This includes reviewing previous studies, theories, and relevant data from journals, books, or other credible sources. After gaining insights from the literature, the next step is data collection, where relevant data from the studied references are gathered.

Following data collection, the research proceeds with the design of the Position Information and Ship Ticket Ordering system. At this stage, the necessary components are identified, and a conceptual framework for the system is developed. Once the design is finalized, the next phase involves creating a program for ship position information and ticket reservations, where the system is built based on the established design.

After the program is developed, testing is carried out to ensure the system functions properly. If the ship's presence is successfully detected, the results are recorded. However, if any issues arise, modifications and refinements are made by revisiting the design and implementation stages. Once the system performs as expected, the next step is data collection and analysis, where the research findings from the testing phase are evaluated.

Finally, the research concludes with report preparation, where the entire research process is documented, findings are summarized, and conclusions are drawn based on the results obtained.

The design that will be made aims to facilitate system design, so a system block diagram is needed, in this research it is shown in Figure 1. which is the overall flow diagram for planning the ship position monitoring system using GPS GT08.

In general, the design of this system is divided into three parts, namely hardware devices, servers, and user interface. In the hardware device section, there is the main device for this research, namely the GPS Tracker GT08, where this GPS has a sim card installed which contains a data package to be able to connect to the server via the internet network, next there is an accimulator which functions as a resource for the GPS GT08 device.

Then there is also a switch button along with a buzzer which functions as an alarm button when the ship experiences problems and needs help. The GT08 GPS device will get coordinate points in the form of latitude and longitude from a GPS set and then by utilizing the Internet network it will be connected to the website that has been designed.

In the second part, namely this server, there is Flespi, which is an IoT (Internet of Things) service provider platform that focuses on collecting, processing and analyzing data from IoT devices. This Flespi is used for communication from the GT08 GPS device which will later be integrated into the website that has been designed. Then for the data storage database, it uses MySQL with the PHP programming language.

In the third part is the website interface, this designed website will have several features, namely the first is a ship position information feature where the website will display the current position of passenger motor ships in the form of maps in real time. Apart from displaying the position of the passenger motor ship, the website will also display the ship's current speed, the battery condition of the device and the signal strength received at the ship's location. And the website will display notifications and sound an alarm if the ship is in an emergency when the switch button on the hardware device is pressed.

Next is the ticket booking feature for passengers to make it easier for passengers who want to buy tickets online. This feature will display the ship's route selection, departure date selection, and also the desired number of passengers. After that, you will be asked to enter passenger data according to the number of passengers entered, then the website will display the amount of fees that must be paid and also the choice of payment method.

To confirm the ticket purchase, it will be confirmed via the WhatsApp number that was registered at the start. To make it easier for passengers, tickets that have been sent via WhatsApp will be accompanied by a link to see the position of the ship without having to log in to the Sumber Mutiara website. Then for other menus there is a history menu and also an information services menu which contains traces of ticket purchases on the website and information regarding ship schedules and other important information.

The flow diagram for designing a ship position information system begins with the start process, where the hardware device is turned on and connected to the internet network. The GT08 GPS device then establishes a connection with the system server using Flespi as the communication link. Once connected, the GPS GT08 sends coordinate data obtained from satellites to the position information system server, where the web server receives and processes the coordinates.

The system then displays the ship's location on the user interface in real-time using maps. In addition to location data, the web interface also presents information about the ship's speed, signal strength, and device battery condition from the GPS GT08. If the ship is in need of assistance, the captain or crew member can press the emergency button (switch button) on the hardware device. This action triggers a buzzer sound, and the GPS GT08 sends emergency data to the system server. If no assistance is needed, the website will continue to function normally while displaying a danger notification and sounding an alarm if required. The process concludes once all necessary data has been received and displayed.

The process begins with the initial step where passengers are directed to the login page. If they already have an account, they can log in using their registered phone number and password. If the login is successful, they will be directed to the main page of the Sumber Mutiara website. However, if the login fails, passengers must retry the login process. If they do not have an account, they need to register first before they can access the website. During the registration process, passengers are required to input their name, phone number, and password. If the registration is successful, the data is stored in the system database, and a notification confirming the successful account registration is displayed. The website will then automatically redirect them to the login menu, where they can log in using the credentials they just created. If the registration fails, passengers must repeat the registration process from the beginning until it is successful. Once the account is created and the login is completed, the registration and login process is considered finished.

Once logged in, passengers can proceed with the ticket ordering process. They begin by selecting the "Ticket Order" menu, located on the right side of the website. They then choose the available ship route, which operates between Larantuka Harbor and Waiwerang Harbor in both directions. After selecting the route, passengers specify the departure date and indicate the number of passengers, as one registered account can book tickets for multiple passengers. Next, they input the necessary passenger details, including ID card numbers and names. The website then calculates and displays the total price along with a payment button. To proceed, passengers must press the payment button and choose their preferred payment method. The system then processes the payment, particularly if it is made via bank transfer. If the payment is successful, the system sends a confirmation message to the registered WhatsApp number associated with the passenger’s account. If the payment fails, an error message is displayed, and passengers must retry the payment process. Once the ticket purchase is successfully confirmed, the ticket ordering process is complete.

The ship position information system operates through several key steps. The process starts when the hardware device is turned on and connected to the Internet. The GT08 GPS device establishes a connection with the system server using Flespi as the communication link. Once connected, the GPS GT08 collects coordinate data from satellites and transmits it to the position information system server. The web server then receives the coordinates and processes the data. The system displays the ship's real-time location on the user interface in the form of a map, along with additional information such as ship speed, signal strength, and the battery status of the GPS device.

If the ship requires assistance, the system includes an emergency response mechanism. In case of an emergency, the captain or a crew member can press the emergency button on the hardware device. When activated, the buzzer sounds an alarm, and the GPS GT08 sends an alert to the system server. If the system detects a problem but no emergency button is pressed, the website will still display a danger notification and trigger an alarm to alert the relevant authorities. Once the system has responded accordingly, the process concludes.

The development of this website-based information system follows several key research stages. The first stage involves conducting a literature study, which examines the background and problem formulation of the research. This is followed by reviewing previous studies, theories, and references from journals, books, and other reliable sources to support the research. After completing the literature study, the next stage is data collection, which involves gathering relevant data from previous research and sources studied earlier.

Following data collection, the design phase begins, focusing on creating a position information and ship ticket ordering system. This involves determining the necessary components and structuring the system accordingly. Once the design is finalized, the next step is implementing the system by developing the program for ship position tracking and ticket reservations. After coding and implementation, the system enters the testing phase. This involves verifying the functionality of the position information system and ticket ordering features. If the ship's location is detected successfully, the system proceeds to the next stage. However, if errors occur, the process is repeated, returning to the design phase for necessary modifications.

Once testing is complete, data analysis is conducted based on the research findings obtained during the testing phase. The results are examined to evaluate the system's performance and effectiveness. Finally, the last stage involves preparing a research report, which includes documenting the entire research process, findings, and conclusions drawn from the study. This marks the completion of the research and development process for the website-based information system.

A list of tools and materials that will be used in the research will be attached as shown at Table 1 and 2. Table 1 specify detailed hardware requirements and Tabel 2 shows the list of software requirements in this study.

TABLE I
TABLE OF HARDWARE USED

No.	Tool Name	Description
1.	GPS Tracker GT08	As a reader device to determine the position and speed of passenger motor ships
2.	SIM Card Telkomsel	As an Internet network provider
3	Accimulator	Resources for GPS GT08
4	Buzzer	As a ship alarm warning in an emergency
5	Tombol Switch	As a replacement for the SOS button, for danger alarm notifications

Parameters in the research on Website Based GPS GT08 Integrated Passenger Motor Ship Ticket Information System and Ticket Ordering are as follows:

1. Accuracy of GPS GT08: the accuracy of the position of the motor vessel provided by the tracking system and the actual location of the passenger motor vessel at any given time.
2. Success of Danger alarm notification: testing the time delay that results when pressing the danger alarm on the hardware device and the time the notification appears on the website.
3. Functional Testing of the features on the Sumber Mutiara website:
   - Account registration and log in feature
   - Ticket booking feature
   - Testing the success of ship ticket payments.

Overall testing of the ship position information system and website-based GPS GT08 integrated passenger motor ship ticket ordering.

TABLE II
TABLE OF SOFTWARE USED

No.	Software Name	Information
1.	Flespi	As a special IoT platform used to manage data and communications from IoT devices (GPS GT08) which will be integrated into the Sumber Mutiara website
2.	Mysql	As a database storage platform
3	Php	As a programming language that runs on a web server
4	Visual Studio Code	As an open source source code editor platform

III. RESULTS AND DISCUSSION

The results and discussion chapter is a chapter that contains the results and discussion of the implementation of mechanical, electrical and application planning in the previous chapter. This chapter will explain the mechanical, software implementation and testing of several parameters. This testing is needed to determine the specifications and capabilities of the system that has been created. The place and time used for testing this research are:

- The place used as the location for testing ship position information is from Ujung Kali Mas Harbor to Kamal Bangkalan Harbor on September 14 2023.
- The place used as a location for testing the functionality of the functions on the Sumber Mutiara website is the Ashabul Kahfi Student Islamic Boarding School, Malang City from October to October 2023.

A. Mechanical Implementation Results

The following is an implementation of a mechanical design consisting of a front view and a side view as shown in Fig. 1 and Fig. 2. Fig. 1 is a picture of the mechanical implementation of the front view, where from the front view there is a GPS GT08 and also a switch button, these two components are deliberately placed outside the glass to make it easier for the captain or crew to press the switch button if the ship needs help. and makes it easier for the GT08 GPS to get

an internet signal. In Fig. 2 is a picture of the results of the implementation from the side view, here you can see the buzzer, accumulator and jumper from the GPS GT08.

Figure 1. Front View Mechanical Implementation Results

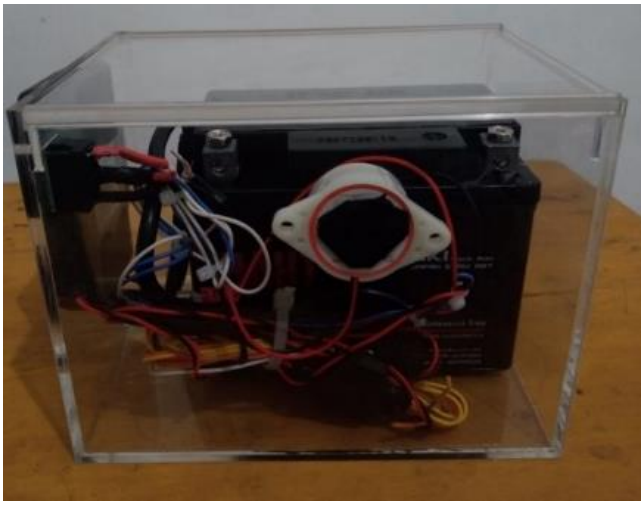

Figure 2. Side View Mechanical Implementation Results

B. Software Implementation Results

The Sumber Mutiara website has several page views, namely the Log in page as the opening page, account registration page, home page, ship position information page, ticket order page and also the order transaction history page. The display results below are the results obtained from running the Sumber Mutiara website on a laptop with the Asus series X441U brand. The specifications of the laptop used are an Intel(R) Core(TM) i3-7020U CPU @ 2.30GHz, 8 Giga Byte RAM, 64 Bit Operating System, and for the Windows system using Windows 10 version 22H2. The following are the results of the page display on the Sumber Mutiara website as shown in Fig. 3.

The Log in page is the first page that appears when accessing the Sumber Mutiara website in a search browser. As seen in Fig. 4, the Log In page displays a telephone number and password button to be able to enter the account that has been registered on the Sumber Mutiara website. Then, if the user doesn't have an account yet, please click on the words "Register Here" to register an account first and then return to the initial log in page to enter the Sumber Mutiara website.

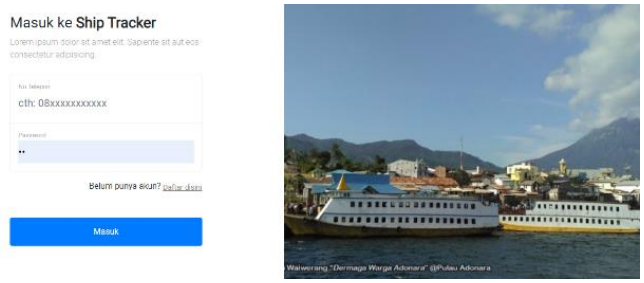

Figure 3. Log in Page Display

The following is a screenshot of the Sign Up or account registration page on the Sumber Mutiara website as shown in Fig. 4.

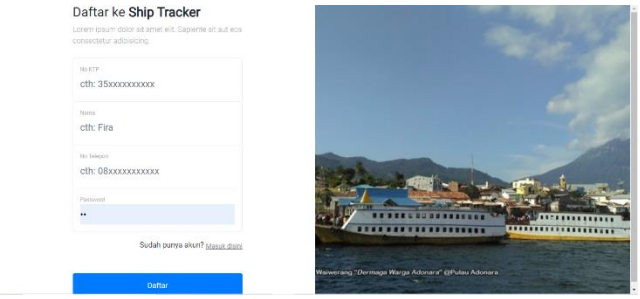

Figure 4. Sign Up Page Display

The Sign Up page will appear when the user clicks "Register Here" on the initial Log In page. As seen in Fig. 4, the Sign Up page will display the KTP Number, Name for Username, Telephone Number and Password button. If you have filled in all your personal data then just click the REGISTER button and if successful then there will be a notification "registration successful". The registered telephone number and password will be used to log in to the Sumber Mutiara website.

The following is a screenshot of the main page of the Sumber Mutiara website as shown in Fig. 5.

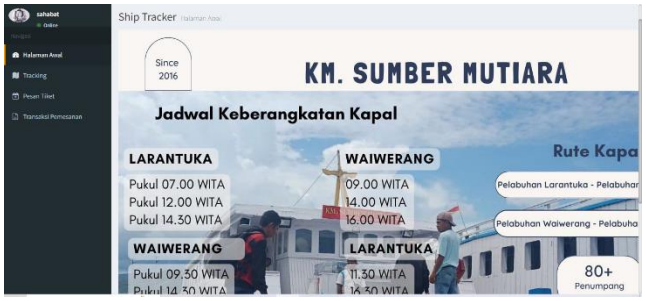

Figure 5. Display of the Main Page of the Sumber Mutiara Website

The main page of the Sumber Mutiara website contains information services for the Sumber Mutiara passenger motor ship. The operational days for this ship are Monday to Saturday. One way from Larantuka Harbor to Waiwerang Harbor takes approximately two hours. For the schedule from KM. The Pearl Source can be seen in Figure 5 above.

The figure 6 is a screenshot of the passenger ticket ordering page on the Sumber Mutiara website.

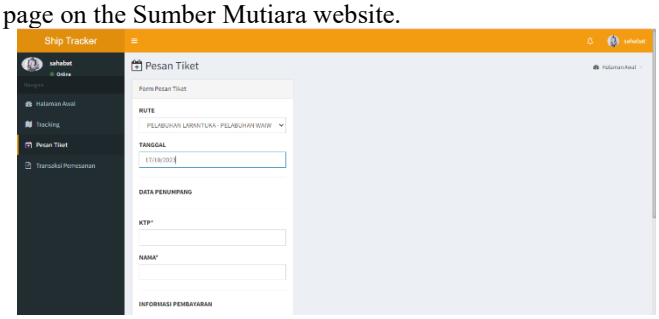

Figure 6. Ticket Order Page Display

As seen in Fig. 6, the ship ticket ordering page will display the desired route selection, departure date and number of passengers as well as personal data for each passenger such as passenger name and population identification number. Once everything is filled in, the payment process will continue.

This booking transaction page displays the history of the results of ticket purchase transactions carried out by passengers as in Fig. 7. You can see the ticket booking history displayed starting from the ship route, transaction date, ticket number, ordering account name, total tickets ordered, total payment, and status. from the ticket order.

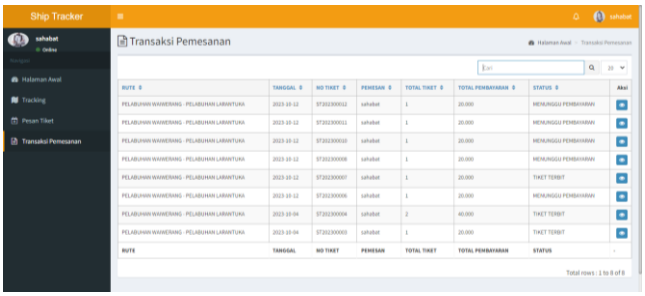

Figure 7. Order Transaction Page Display

This user profile page functions for users of the Sumber Mutiara website to easily edit their information data such as changing their username, selecting a photo to be used as an account profile and changing their respective account passwords as seen in Fig. 8 below.

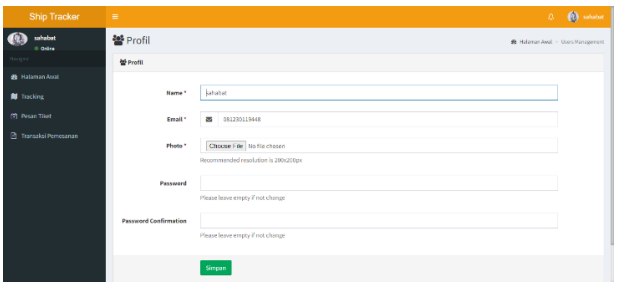

Figure 8. User profile page display

The following is a screenshot of the Ship Position Information page on the Sumber Mutiara website as shown in Figure 9.

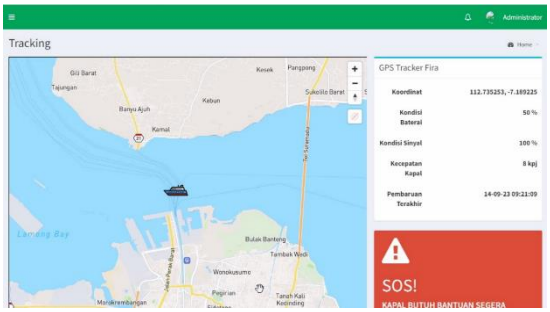

Figure 9. Display of the ship's position information page

This ship position information page functions to help passengers on passenger motor ships to find out the ship's position in real time. As can be seen in Fig. 9, the position of the ship in the sea between Madura Island and Java Island is clearly visible. The ship position information page also includes information such as coordinate points in the form of longlatitude and latitude of the ship's position, ship speed, signal strength, battery condition and the last update.

This web application feature testing is carried out to ensure that the features in the web application can run according to the system design on the smartphone. Testing application features using cellphones and laptops, for smartphones used by users are the Redmi Note 10 Pro, Redmi Note 10, Galaxy A50 S, Samsung A23, Oppo A31 and for the laptop used is the Acer type. The following is the attachment of the results of testing the functionality of the features on the Sumber Mutiara website application.

Testing of this feature was carried out with the aim of being able to see the functionality of the registration and log in menu in accordance with the initial planning. The following are the results of an account registration experiment on the Sumber Mutiara website carried out on several types of cellphones, where each cellphone will register with a different account with its own personal data. This account registration experiment was carried out on 5 types of Android cellphones, namely Redmi Note 10 Pro, Redmi Note 10, Galaxy A50, Samsung A23, and Oppo A31.

The following is an attachment of a table of test results carried out on several smartphones, as shown at Table 3.

TABLE III
SUMBER MUTIARA WEBSITE REGISTRATION TESTING

No.	*Smartphone*	Android Version	Description	
			Log In Success	Failed
1.	Redmi Note 10 Pro	Android 12	√	
2.	Vivo Y30	Android 12	√	
3.	Galaxy A50 S	Android 11	√	
4.	Samsung A23	Android 11	√	
5.	Oppo A31	Android 9	√	

Based on the results of testing data on the registration and log in features, it can be concluded that the registration and log in features on the Sumber Mutiara website are working well so that they can be used by ship passengers to find out information about the ship's position and order ship tickets.

Based on the results of testing data on the ship position information feature and ship ticket reservations on the Sumber Mutiara website, it can be said that the ship position information feature and ship ticket reservations on the Sumber Mutiara website is successful and runs well without any problems when used to view the position of the ship or to order ship tickets. The ship position information system displayed on the website is real time, making it easier for passengers to see the current position of the ship they are about to board or are currently boarding.

Apart from seeing the position of the ship, passengers can also see the speed of the ship and the strength of the signal obtained from the position the ship is in. If something happens on the ship and the ship needs something, the Sumber Mutiara website will sound an alarm and notification on the Sumber Mutiara admin website. This aims to ensure that ships immediately receive assistance from the port and from outside parties. For one account that has successfully logged in to the Sumber Mutiara website, you can order more than one boat ticket.

The results of testing the success of ordering tickets at Sumber Mutiara. This stage is divided into six stages starting from selecting the payment method, then the selected payment method appears, then the Virtual Account number and the nominal amount that must be paid appear. Payment is made by transfer to a flip account. The transaction will be processed and if the ticket payment is successful, the passenger will receive a message on the registered WhatsApp number registered on the website, then passengers can see the ship's position in real time via the ship tracking link which is sent along with confirmation of the ship ticket. So this makes it easier for passengers to track the ship's position without having to log in first to the Sumber Mutiara website.

The results of testing the accuracy of the ship's position regarding coordinate points were carried out using 15 trials on the Surabaya - Madura crossing. The coordinates of the screenshots on the Sumber Mutiara website are compared with the coordinates on Google Earth. The results obtained were that the Latitude accuracy percentage was 98.865% and the Longitude accuracy percentage was 99.742%. In other words, the level of accuracy of ship positions on the Sumber Mutiara website is very high and worthy of implementation.

Meanwhile, the test results delay alarm notifications on the website by pressing the emergency button on the device. The test was carried out using a stop watch to see the delay in the appearance of the alarm notification. The results obtained were that the average alarm notification delay on the website was 16.24 s. This delay result is caused by several factors such as the internet network, especially if the ship is far from the island.

Next, testing the registration and log in features on the Sumber Mutiara website ran well using 5 different smartphones so that they could be used by ship passengers. Then test the ship position and ticket booking features. Furthermore, testing of the features on the Sumber Mutiara website includes the ship position information menu which can be accessed properly, the ticket order menu also displays data that must be filled in by passengers, and the add passenger menu functions well.

IV. CONCLUSION

The research on the "Ticket Ordering System and Website-Based GPS GT08 Integrated Passenger Motor Ship Position Information" successfully developed a highly accurate passenger motor ship position information system integrated with the GT08 GPS device, achieving 98.865% accuracy for Latitude and 99.742% for Longitude. The Sumber Mutiara website was successfully designed for ticket reservations and real-time ship position tracking, displaying essential data such as route, date, passenger identity, coordinate points, battery and signal conditions, ship speed, and last update. System testing confirmed the accuracy of coordinate tracking, with an alarm notification delay of 16.24 seconds and smooth functionality of the registration and login features across different smartphone models. To enhance future developments, it is recommended to integrate the emergency alarm notification feature with various sensors for specific emergency indicators, expand ship routes for broader public access, and incorporate valid departure and arrival time features while collaborating with the Maritime Transportation Department to improve passenger satisfaction and operational efficiency.

REFERENCES

[1] Amin, M., et al. (2023). "Enhancing Maritime Transportation Through Digital Innovations." Journal of Transportation Technology, 17(3), 120-135.

[2] Hakim, R., et al. (2022). "Challenges in Implementing Smart Maritime Systems in Remote Areas." Maritime Policy Review, 8(2), 98-112.

[3] Hartanto, Y. (2022). "GPS-Based Monitoring for Improved Maritime Safety." Journal of Navigation and Logistics, 19(1), 75-89.

[4] Hidayat, A., & Pratama, R. (2021). "The Role of GPS Technology in Enhancing Vessel Safety." Indonesian Maritime Review, 14(2), 103-118.

[5] Ministry of Transportation of Indonesia. (2023). "Maritime Highway Program and Its Impact on Indonesia's Connectivity." Government Policy Report.

[6] Ningsih, D., & Wibowo, S. (2022). "Financial Transparency in Ferry Operations: The Impact of Digital Ticketing." International Journal of Maritime Business, 10(4), 210-225.

[7] Nugroho, B., et al. (2023). "Adoption of Web-Based Ticketing Systems: Lessons from the Airline and Railway Sectors." Transportation Systems Journal, 15(2), 87-104.

[8] Putra, F., et al. (2023). "Revenue Leakage in Maritime Operations and the Role of Digital Payment Solutions." Journal of Transport Economics, 13(3), 145-159.

[9] Rahman, T., & Setiawan, H. (2022). "Manual Ticketing and Its Implications on Maritime Passenger Management." Asian Maritime Journal, 22(1), 112-129.

[10] Santoso, A., et al. (2023). "Comparative Study of Digital Ticketing Systems Across Different Transport Modes." International Journal of Smart Transportation, 11(1), 33-48.

[11] Sari, R., & Fadilah, P. (2021). "Maritime Safety and Overcrowding in Indonesian Passenger Ferries." Journal of Marine Safety, 9(2), 89-105.

[12] Suryadi, B., & Fajar, R. (2023). "Sustainable Solutions for Maritime Transportation in Indonesia." Sustainable Transport Journal, 7(4), 65-80.

[13] Sutanto, E., et al. (2021). "Manual vs. Digital Ticketing: Efficiency and Accuracy in Passenger Data Management." Journal of Transportation Studies, 18(2), 56-72.

[14] Wijaya, R., et al. (2022). "Optimizing Maritime Transport Operations with GPS-Based Technologies." Smart Maritime Innovations Journal, 16(3), 78-92.

[15] Yusuf, K., et al. (2020). "GPS Tracking in Maritime Operations: Safety and Efficiency Perspectives." Journal of Navigation Technology, 14(1), 99-113