INVENTOPIA 2025

FBM-SEREMBAN INTERNATIONAL INNOVATION COMPETITION (FBM-SIIC)

INNOVATION IN ACTION: TURNING IDEAS INTO REALITY

Chapter 50
PilotHub

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ABSTRACT

Efficient pilotage is crucial for safe, timely, and cost-effective port operations, but traditional systems often struggle with delays, high costs, and poor coordination. As part of our IBM554 International Trade course at Universiti Teknologi MARA, we developed *PilotHub*—an innovative mobile app designed to modernize pilotage operations. Pilots face challenges like delayed ship movements, disrupted schedules, and excessive paperwork. PilotHub solves these problems using AI for smart pilot assignment, AR for safer navigation, and digital tools to replace paperwork. The app is mobile-friendly, letting pilots and dispatchers coordinate in real-time. Pilots can log in to see their dashboard with job details, weather, and tide info. They receive assignments based on license type and ship requirements, reducing wait times. AR helps guide ships safely in port, and digital logs make reporting fast and easy. PilotHub is designed for port authorities, pilot services, and shipping companies, offering easy integration and global scalability. We also surveyed 30 maritime professionals to gather feedback and improve the app. Overall, PilotHub improves safety, reduces delays, and streamlines operations, setting a new standard for smart port management.

Key Words: International Trade, Pilotage Services, Port Operation

1. INTRODUCTION

1.1 Objectives

The primary objective of the creation of PilotHub is to develop a mobile and web-based platform that enables real-time monitoring and management of port pilot operations. This objective is taken into consideration after evaluating the self-deployment concerns by pilots at the port, which lead to issues like delayed ship movements, increased cost, disrupted supply chain, inefficient scheduling, and lack of transparency. To achieve this, PilotHub is designed with the following specific objectives; provide instant embarkation/disembarkation

status updates, optimize pilot scheduling through digital planning tools, enable communication between ships, port authorities, and pilots in one platform, record and store historical data for performance analytics, and minimize ship idle time and improve turnaround efficiency.

1.2 Problem Statement

1.2.1 Delayed Ship Movements

Self-deployment by the pilot might create delays in ship movement. This is because the pilot must independently comprehend the data displaying the ship's movement. If the data collected is erroneous, the ship's trip will be hampered since it will have to wait for a new pilot to guide it to its intended location.

1.2.2 Increased Cost

More expenses at a hub owing to self-deployment issues can be caused by a variety of factors, including more infrastructure requirements, complexity, and potentially longer deployment times. These concerns can result in increased expenses in a variety of areas, including software licensing, hardware upgrades, and manual intervention (Kelkar et al., 2025).

1.2.3 Disrupted Supply Chain

When vessels are unable to dock and unload due to a lack of pilots, the port becomes congested, with vessels awaiting entry or exit. This can cause delays in the movement of products, potentially leading to market shortages (Sild, 2024).

1.2.4 Inefficiency Scheduling

A pilot shortage causes schedule problems. Vessels cannot be piloted until a pilot is available, causing delays and even bottlenecks. As a result, vessels may have to wait in port approaches or designated zones until a pilot is available, increasing wait times and expenditures (Hematian et al., 2025).

1.2.5 Lack of Transparency

The lack of openness makes it difficult to monitor pilot numbers, retirements, and training progress. This causes poor planning and delays in hiring or training new pilots. It also has an impact on recruiting, retaining employees, and running daily operations. As a result, pilot shortages intensify, and port efficiency declines.

2. DESCRIPTION OF THE INNOVATION

2.1 Pilot Booking

Pilots can view all incoming vessel assignments with full details including ship ID, license type, estimated time of arrival (ETA), and departure. AI-powered scheduling automatically assigns pilots based on their license level, qualifications, and availability—minimizing manual effort and reducing scheduling conflicts.

2.2 Personal Dashboard

Gives pilots a clear view of upcoming assignments, including boarding times, ship details, and port information. It also provides live weather updates and forecasts to help pilots prepare for changing conditions. With real-time alerts and a mobile-friendly design, pilots can stay informed and ready, ensuring smooth, efficient, and safe operations.

2.3 Real-Time Ship

The app integrates with a to show live locations of vessels approaching or departing the port. Filters allow users to display specific vessel types such as cargo ships, tankers, passenger liners, or fishing boats for better planning and resource allocation.

2.4 Anchorage Data

The “Anchorage Data” tab provides detailed tidal data including today’s and tomorrow’s high and low tide times specific to each port (e.g., Kampung Pasir Gudang). Live weather updates help pilots prepare for changing maritime conditions and improve safety.

3. PRODUCT USAGE

The PilotHub app is designed to be user-friendly and modern, making it easy for pilots and port staff to use. Users log in with a unique ID and password to keep their information secure. After logging in, they see a dashboard with upcoming assignments and ship tasks. In the pilot booking section, users can search for ships by entering the ship ID, license type, ETA (Estimated Time of Arrival), and ETD (Estimated Time of Departure). AI helps match pilots to ships based on their qualifications. The personal dashboard also shows weather updates, assignment details, and ship information. A real-time tracking page lets users follow ship movements live. The anchorage tab provides tide information based on port location to support accurate scheduling. PilotHub improves communication and coordination between key port stakeholders—like port authorities, marine agents, and pilots.

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4. SURVEY AND FEEDBACK

We received great feedback from the community about PilotHub, showing strong interest in the app. To better understand user needs, we ran surveys using Google Forms. The survey focused on whether people wanted a tool that could improve their pilotage experience, thus helped us design more user-friendly features and make PilotHub more effective to use.

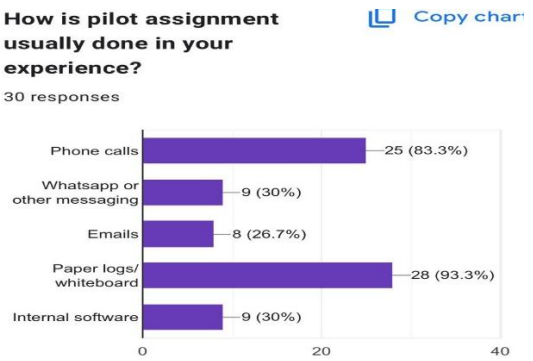

Figure 1: Questionnaire

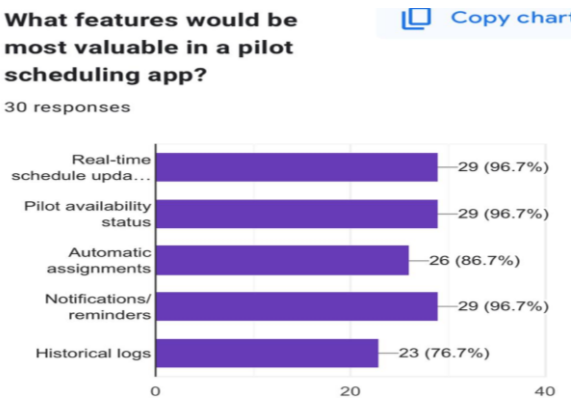

Figure 2: Questionnaire

5. COMMERCIALIZATION POTENTIAL

5.1 Potential for Commercialization

The commercialization journey will focus on how PilotHub's features help in figuring out predicament in port industries as this AI platform will solve real-world problems for these stakeholders, ultimately leading to increased efficiency, optimized operational performance, safety, and cost saving. PilotHub presents strong commercialization potential by directly addressing key challenges in the port industry through its innovative AI-driven features. The platform enhances efficiency and reduces costs by using AI for smart pilot assignments and streamlined communication, which shortens vessel turnaround times and boosts overall productivity. Its AR navigation and digital log features significantly improve safety and resilience, helping reduce human error and the risk of maritime accidents. By integrating cutting-edge technologies, PilotHub supports operational excellence, enabling port authorities to modernize their systems and improve their global competitiveness. Additionally, the platform's data analytics tools empower port operators to make informed, data-driven decisions by identifying performance gaps and optimizing resource allocation. The app also minimizes delays and eliminates paperwork through digital automation, resulting in a seamless, faster, and more reliable pilotage process for all stakeholders involved.

5.2 Benefits to End Users

PilotHub benefits multiple stakeholders in port operations by streamlining processes and enhancing coordination. For pilots, it offers improved navigation and scheduling through ai-based assignments, live ship tracking, mobile accessibility, and digital log submission, reducing paperwork and enhancing safety. Port authorities gain real-time updates that improve communication with pilots and agents, while data insights support smarter decision-making and seamless integration with existing systems. Marine agents can monitor vessel movements, manage port entry and clearance, and receive accurate ETA/ETD updates. Real-time collaboration with pilots and port staff improves planning, reduces delays, ensures compliance, and leads to significant cost savings.

6. CONCLUSION

PilotHub presents an innovative, tech-driven solution to modernize marine pilotage operations by addressing common challenges such as inefficiencies, delays, and lack of transparency. By integrating AI for scheduling, AR for navigation, and digital tools for compliance, it significantly improves safety, communication, and operational performance in port management. The positive feedback from stakeholders and the potential for global scalability highlight its commercial viability, making PilotHub a valuable contribution to the future of maritime logistics.

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