

CargoLinker: Streamlined Container Booking App

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Abstract: *The global shipping and logistics industry play a vital role in facilitating international trade, yet small-scale exporters often face challenges in booking cargo container space efficiently. CargoLinker is a web and mobile application designed to bridge this gap, connecting exporters with available cargo container space in a streamlined manner. It is developed using an open source framework named Flutter, CargoLinker aims to enhance the efficiency and affordability of cargo shipping for small-scale exporters. The main aim of this application is to minimize the cost for small traders and maximize the profit for the company. This paper presents an overview of CargoLinker, its features, benefits, development process, challenges, and future directions.*

Keywords: Cargolinker, Flutter, logistics industry, shipping.

I. INTRODUCTION

The global shipping and logistics industry serve as the backbone of international trade. However, small-scale exporters frequently encounter obstacles in booking cargo container space, resulting in operational inefficiencies and increased costs. CargoLinker addresses this issue by providing a user-friendly mobile application that connects exporters with available cargo container space in a streamlined and efficient manner. This paper explores the development and potential impact of CargoLinker in revolutionizing the container booking process for small-scale exporters. The "CargoLinker" project aims to bridge the gap between traders and logistic services, offering a solution to exporters of small consignments. It facilitates the process of finding and booking available spaces in partially filled cargo containers. Developed using the Flutter framework, this mobile application has been designed to streamline cargo shipping for small exporters and connect them with available logistics services efficiently.

CargoLinker is a streamlined container booking app that helps exporters of small consignments find and book available spaces in partially filled cargo containers. The app is built using Flutter, A cross-platform development framework that allows developers to create native-looking apps for iOS and Android devices.

In an increasingly interconnected global economy, the shipping and logistics industry serves as the backbone of international trade, facilitating the movement of goods across borders. However, for small-scale exporters, navigating the complexities of cargo booking can often be daunting and inefficient. The challenge lies in accessing available container space swiftly and affordably to meet their shipment needs. To address this pressing issue, we introduce CargoLinker—a revolutionary mobile application poised to revolutionize container booking processes for small-scale exporters. CargoLinker stands as a beacon of efficiency and convenience, offering a streamlined solution to connect exporters with available cargo container space seamlessly. Developed using cutting-edge Flutter technology, CargoLinker represents a paradigm shift in how small-scale exporters approach cargo booking. By harnessing the power of digital innovation, CargoLinker empowers exporters to overcome logistical barriers, enabling them to focus on what matters most: growing their businesses.

In this paper, we delve into the intricate details of CargoLinker—its features, benefits, and the transformative impact it promises to deliver. Through a comprehensive exploration of its development process, challenges encountered, and future directions, we aim to shed light on the potential of CargoLinker to reshape the landscape of international trade. Join us on this journey as we unravel the potential of CargoLinker to catalyze efficiency, accessibility, and affordability in the global shipping and logistics industry.

II. LITERATURE SURVEY

A Guo, D., Du, X., & Wu, G. (2018, June). Optimization of multi-dimensional container slot allocation based on joint dispatch and mutual renting. In 2018 Chinese Control And Decision Conference (CCDC) (pp. 6155-6160). IEEE.[1]

This proposed system is based on the multi-dimension of container type, size, capacity and deadweight tonnage combined with long-term contractual customer booking requirement and the randomness of supply demand. This model is transformed into integer linear programming by using robust optimization methods which can be solved by the Lingo software package.

B Tian, J., & Chang, D. (2016, July). A research on empty container allocation problem. In 2016 International Conference on Logistics, Informatics and Service Sciences (LISS) (pp. 1-5). IEEE.[2]

This proposed system is related to empty container allocation and management related to the degree of container utilization. Through rational empty container allocation, you can reduce transportation costs under the premise of meeting the heavy container of normal transportation. This article considers the lowest cost of the empty container allocation and minimal time of total deviation as the goal, establishing it as the bi-objective programming model.

C Liu, C., Jiang, Z., Liu, L., & Geng, N. (2013). Solutions for flexible container leasing contracts with options under capacity and order constraints. International Journal of Production Economics, 141(1), 403-413.[3]

This paper tackles the container planning problem from the carrier's perspective in a two-echelon container shipping service chain (CSSC), which includes one carrier and one upstream rental company. A flexible contract with options is introduced into a one-period container planning mechanism. With that contract, the rental company requires the carrier to make a commitment or place an order in advance. Options gives buyer the right to modify the initial orders to better match the supply with the demand and further consider the shipping capacity and the minimum order constraints

D Feng, B., & Ye, Q. (2021). Operations management of smart logistics: A literature review and future research. Frontiers of Engineering Management, 8, 344-355.[4]

This paper is proposed on the new challenges in the logistic industry after online and offline channels have been integrated. So to tackle this problem smart logistics is introduced for handling the increasing complexity and volume of logistics operations. Operations management research on smart logistics is going in the fields of application of underlying technologies, business logic, operation framework, related management system and optimization problem under specific scenarios.

E Tang, Y., Chen, S., Feng, Y., & Zhu, X. (2021). Optimization of multi-period empty container repositioning and renting in CHINA RAILWAY Express based on container sharing strategy. European Transport Research Review, 13, 1-12.[5]

This proposed system is related to optimization of empty container transfer and rent under container sharing between China and Europe. It reduces the operation cost of the container sharing. It creates a multi-period empty container transportation model with lowest total cost and stability of the network combining with container sharing strategy. To transform complex problems into single period problem Lyapunov optimization method is used and then genetic algorithms is used to solve the whole model.

III. PROJECT OVERVIEW

CargoLinker is a mobile application tailored for small-scale exporters, enabling them to find and book available space in partially filled cargo containers. By simplifying the booking process and offering a user-friendly platform, CargoLinker aims to optimize cargo shipments and reduce transportation costs. The application facilitates direct booking with shipping lines, eliminating the need for intermediaries and saving exporters time and money.

CargoLinker works by searching for available spaces in partially filled cargo containers on ships that are departing from the exporter's desired port and arriving at the importer's desired port. Once the exporter has found a suitable space, they can book it directly through the app. Also we have developed a Web page for app Owner so that with that interface Owner can approve the company and monitor other rules and regulations.

IV. MARKET RESEARCH

The global shipping and logistics industry constitute a cornerstone of international trade, facilitating the movement of goods across borders. However, for small-scale exporters, accessing and booking cargo container space efficiently can be challenging due to various factors such as limited resources, lack of visibility into available options, and complexities in the booking process. To address these challenges and tap into the growing demand for streamlined logistics solutions, a comprehensive market research analysis was conducted to assess the feasibility and potential of CargoLinker in the market.

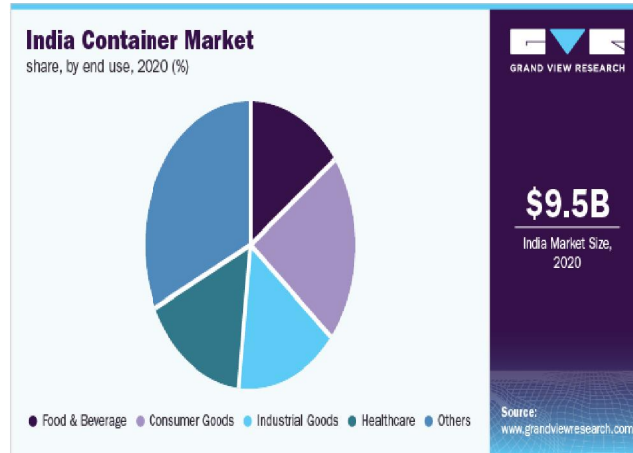


Fig 4.1 Usage of Container.

Based on the market research findings, there is a clear opportunity for CargoLinker to address the unmet needs of small-scale exporters and capitalize on the growing demand for streamlined logistics solutions. By leveraging technology, offering user-friendly features, and focusing on customer-centricity, CargoLinker aims to carve out a niche in the competitive landscape and establish itself as a trusted partner for small-scale exporters in the global trade ecosystem.

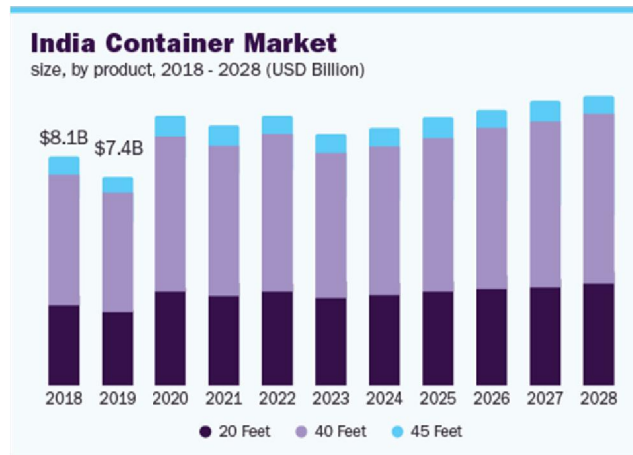


Fig 4.2 Analysis by size of Container.

V. PROPOSED SYSTEM

The Problem Statement is an App that provides exporters of small consignment to find & book available spaces in partially filled cargo containers. Exporters of small consignments typically have to rely on freight forwarders to book space on cargo ships. However, freight forwarders typically charge high fees and can be slow to respond to inquiries. CargoLinker addresses this problem by allowing exporters to book space directly with shipping lines, eliminating the need for a middleman and saving exporters money and time. The user interface of CargoLinker is designed to be

intuitive and user-friendly. It employs a modern and clean design, making it easy for users to navigate the application. Screenshots and UI mock-ups can be provided in the appendix.

The main Objective of this project is to Develop a mobile application using Flutter. Provide a platform for small exporters to search and book cargo container space. Streamline the container booking process. Enhance user experience and convenience. Facilitate cost-effective shipping for small consignments.

I] Use case Diagram :

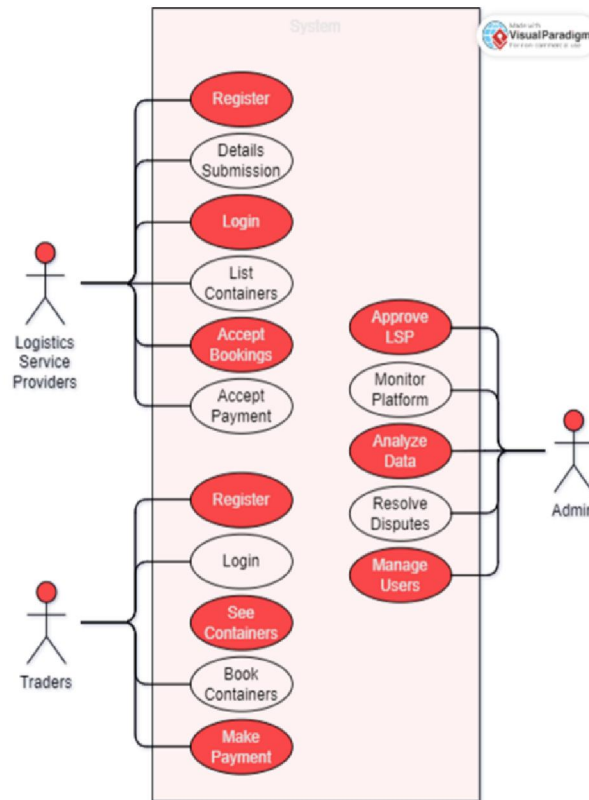


Fig 5.1 Use Case Diagram.

III] Some Major Use Cases are in field of :

- Food and beverage products: CargoLinker can be used to book space for food and beverage products that need to be shipped at a specific temperature or humidity level. Electronics: CargoLinker can be used to book space for electronics that need to be protected from shock and vibration during shipping.
- Pharmaceuticals: CargoLinker can be used to book space for pharmaceuticals that need to be shipped under strict temperature and humidity controls.
- Textiles: CargoLinker can be used to book space for textiles that need to be protected from moisture and dust during shipping.
- Machinery and equipment: CargoLinker can be used to book space for machinery and equipment that needs to be securely fastened during shipping.

III] Challenges

- Integration of Google Maps API for location-based services.
- Ensuring secure user authentication and data protection.
- Implementing real-time updates for container availability.

- Payment integration for booking confirmation.
- Ensuring a responsive and visually appealing user interface.

IV] Flow Chart

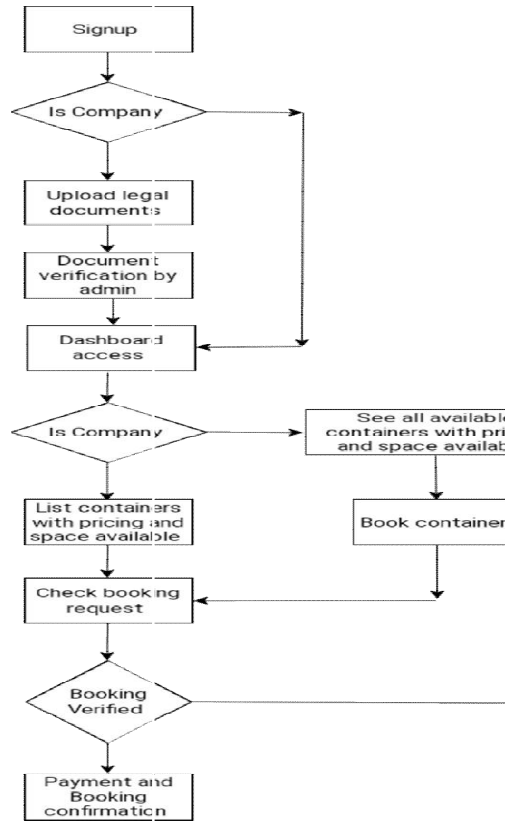


Fig 5.2 Flow Chart

VI. DEVELOPMENT PROCESS

The development process of CargoLinker followed a systematic approach encompassing various stages crucial for the successful implementation of the project. This section provides an overview of each stage, highlighting the methodologies, tools, and techniques employed to achieve the desired outcomes.

I] Requirement Analysis

The development journey of CargoLinker commenced with an exhaustive requirement analysis phase. This involved meticulous examination and documentation of the needs, expectations, and challenges faced by small-scale exporters in the cargo booking process. Through stakeholder consultations, market research, and user feedback mechanisms, a comprehensive understanding of the target audience's requirements was attained.

III] System Design

Based on the insights gathered during the requirement analysis phase, the system design phase commenced. This phase involved the conceptualization and visualization of CargoLinker's architecture, functionalities, and user interface. Utilizing industry-standard design principles and tools such as wireframing and prototyping software, the system design phase laid the foundation for the subsequent development stages.

III] Frontend Development (Flutter)

With the system design blueprint in place, the frontend development phase commenced using Flutter—a versatile cross-platform framework. Flutter's capability to deliver native-like user experiences across multiple platforms made it the ideal choice for CargoLinker's frontend development. Through iterative development cycles, the user interface elements, navigation flows, and interactive components were meticulously crafted to ensure optimal user engagement and satisfaction.

IV] Backend Development (Firebase):

Simultaneously, the backend development phase unfolded, leveraging Firebase—a robust cloud-based platform. Firebase offered a comprehensive suite of backend services, including authentication, data storage, and serverless computing, enabling seamless integration with CargoLinker's frontend components. The backend development process focused on implementing scalable and efficient solutions to handle user authentication, data management, and real-time communication functionalities.

V] Database Integration

Integral to CargoLinker's backend infrastructure was the integration of a reliable and scalable database system. Leveraging Firebase's Firestore database, a NoSQL document-oriented database, facilitated efficient storage, retrieval, and manipulation of data related to user profiles, cargo bookings, and transaction records. The database integration phase prioritized data consistency, security, and performance to ensure a seamless user experience.

VI] API Integrations

In addition to Firebase services, CargoLinker incorporated various third-party APIs to enhance its functionality and connectivity. APIs for geolocation services, payment gateways, and shipping tracking systems were seamlessly integrated into the application ecosystem. Through API integrations, CargoLinker expanded its capabilities, enabling users to access real-time information, process payments securely, and track shipment statuses with ease.

VII] Deployment

Following successful completion of testing and user validation processes, CargoLinker was deployed to production environments. Deployment strategies focused on ensuring seamless rollout, minimal downtime, and efficient scalability to accommodate varying user loads and demands. Continuous monitoring and optimization efforts were undertaken post-deployment to maintain system stability and performance.

VII. TECHNOLOGY STACK

CargoLinker is built using Flutter, a cross-platform mobile application development framework, and Firebase for backend services. The application leverages Node.js, Express.js, NEXT.js, MongoDB, Mailjet, and MaterialUI to enhance functionality and user experience.

VIII. APP INTERFACE SCREENSHOTS

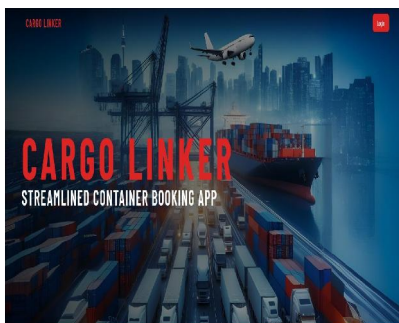


Fig 8.1 Landing Page of App Authority.

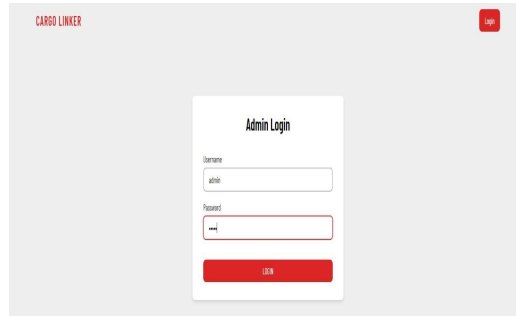


Fig 8.2 Login Page.



Fig 8.3 Verification Page.

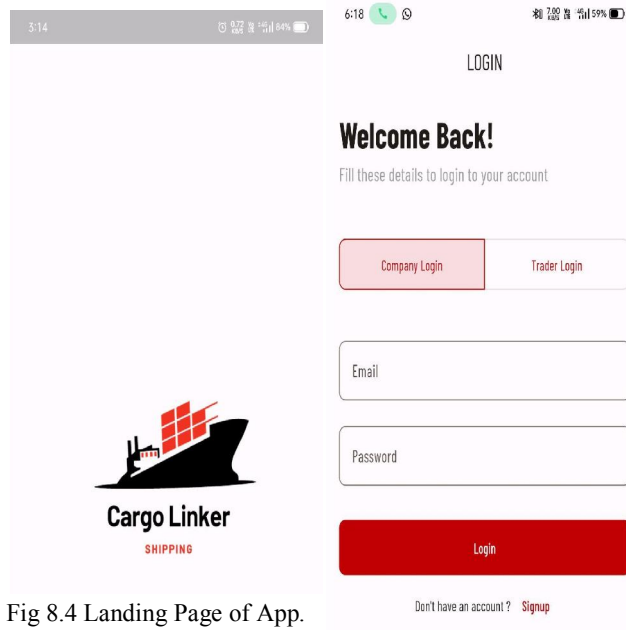


Fig 8.4 Landing Page of App.

Fig 8.5 Login Page of App.

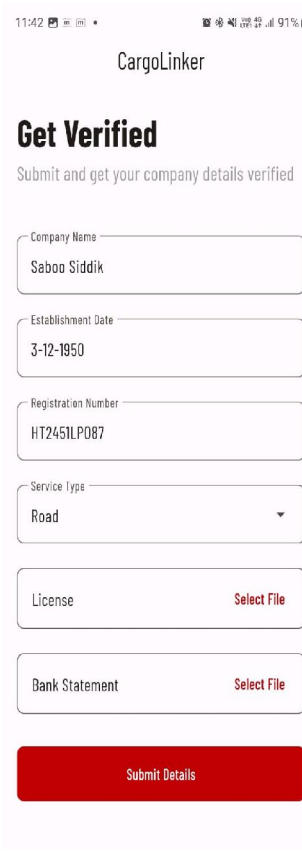


Fig 8.6 Company Details.

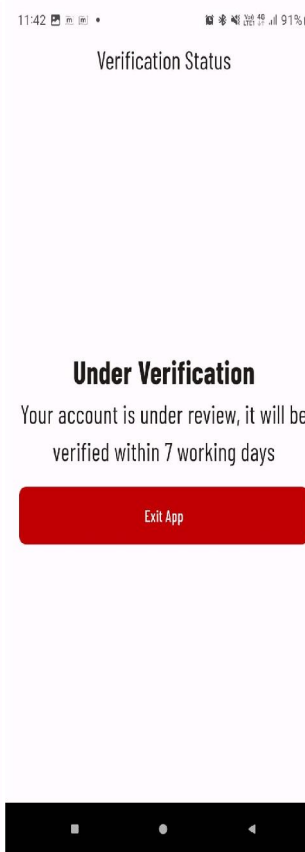


Fig 8.7 Verification Page.

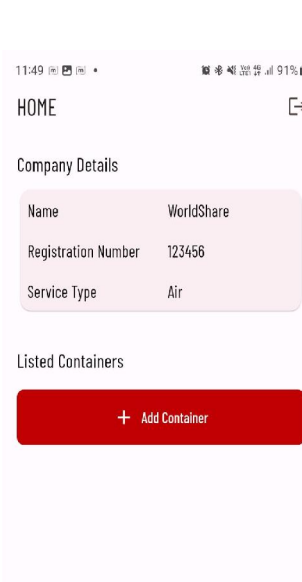


Fig 8.8 Company Home Page.

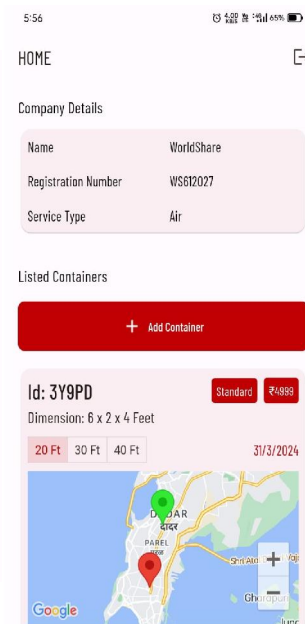


Fig 8.9 Added Containers.

IX. FEATURES AND BENEFITS

CargoLinker offers a range of features including user registration, container search and booking, real-time availability updates, location-based services, payment integration, user notifications, and shipment tracking. The application provides exporters with convenience, transparency, affordability, speed, efficiency, visibility, and reduced risk throughout the shipping process. CargoLinker's features combine to offer small-scale exporters a comprehensive solution for their container booking needs, delivering efficiency, convenience, transparency, and cost savings throughout the logistics process. Through its innovative approach, CargoLinker aims to empower exporters to navigate the complexities of international trade with ease and confidence, driving growth and success in their businesses. By leveraging CargoLinker, small-scale exporters can significantly enhance their efficiency and reduce costs associated with cargo shipping. CargoLinker incorporates a tracking feature that enables users to monitor the status of their shipments from pickup to delivery, providing peace of mind and ensuring transparency throughout the shipping process. The app streamlines the booking process, saving users valuable time and effort while also minimizing the risk of overbooking or underutilization of container space. Moreover, CargoLinker empowers exporters with access to real-time information and competitive pricing, enabling them to make cost-effective decisions and optimize their shipping strategies. With its tracking feature, the app enhances visibility and accountability, enabling users to mitigate potential delays or disruptions and ensure timely delivery of their goods.

X. IMPLEMENTATION DISCUSSION AND FURTHER WORKS

The implementation of CargoLinker encompasses various key features aimed at optimizing container booking and enhancing user experience within the global shipping industry. Initially, the application facilitates the booking of space for full container loads (FCL), streamlining the process for small-scale exporters. Moreover, CargoLinker extends its utility by providing functionality for booking space for dangerous goods, catering to a wider range of cargo types and requirements. Additionally, the integration of a feature to generate customs documents further simplifies the shipping process, ensuring compliance with regulatory standards.

Furthermore, CargoLinker's implementation includes a real-time shipment tracking system, allowing users to monitor their cargo's status even after it has been unloaded from the ship. This feature adds a layer of transparency and accountability to the shipping process, enhancing user confidence and facilitating proactive decision-making. The application also addresses the global nature of its user base by offering multi-language support, accommodating diverse linguistic preferences and fostering accessibility on an international scale. In terms of future works, there are several areas for potential enhancement and expansion. Firstly, integrating with additional shipping providers could broaden the range of container options available to users, further enhancing flexibility and choice. Moreover, the implementation of advanced analytics and reporting features could provide valuable insights into shipping trends and performance metrics, empowering users to optimize their shipping strategies effectively.

Additionally, CargoLinker could explore the implementation of a referral program to incentivize user engagement and expand its user base organically. Furthermore, integration with external shipping tracking systems could enrich the application's tracking capabilities, providing users with comprehensive visibility across multiple platforms. Lastly, the implementation of chat and support services within the application could offer users real-time assistance and troubleshooting, further enhancing the overall user experience.

XI. CONCLUSION

CargoLinker represents a promising solution for small-scale exporters, offering a streamlined and efficient platform for booking cargo container space. By leveraging Flutter and Firebase, CargoLinker aims to revolutionize the container booking process, ultimately enhancing convenience and affordability for traders worldwide.

In conclusion, CargoLinker holds significant potential to transform the logistics industry and improve the shipping experience for small-scale exporters. As development progresses and new features are implemented, CargoLinker is poised to become a valuable tool for traders seeking efficient and cost-effective cargo shipping solutions.

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