ARTIFICIAL INTELLIGENCE USE IN MARITIME AND PORTS INDUSTRY AS SMART MULTIMODAL HUBS - EMERGING TRENDS

INTRODUCTION:

- In considerations of automation, operational efficiencies, and optimal exploitation of existing facilities, developed ports are required.
- Creating adequate amenities at terminals will need huge expenditure. The port's static machinery resource should be used to its full potential. Before establishing any new port, a complete master plan for all major ports should be developed.
- With the implementation of systematic plans for the revitalization of the Logistics sector, now is the moment for the nation to ponder on this infrastructure solution.

INTRODUCTION:

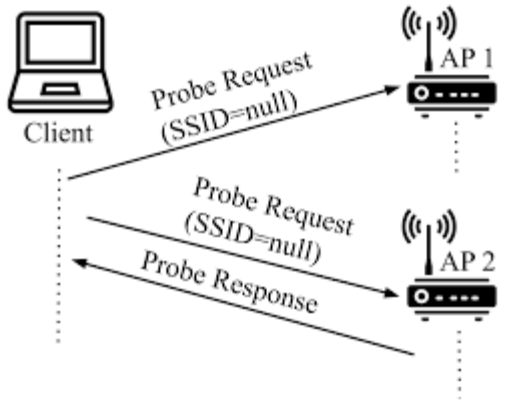
- The principles of multimodal transportation utilization were used to create an effective transit map of Interstate transport routes connecting the major ports in the United States.
- This study draws Multimodal Logistics factors and models them using Artificial Intelligence to represent a massive possibility to rationalize costs, increase efficiency, and reduce carbon emissions.

LITERATURE REVIEW

- The climate change, environmental degradation, and the depletion of energy supplies are all major challenges for shipping in the twenty-first century.
- Seaports are an integral part of the shipping industry's infrastructure. Although there is no universal answer, seaports all over the world suffer the same problem.
- The problems in integrating new technology into automation, traffic congestion, harmonizing residential neighborhoods surrounding the port, measuring and lowering CO2 emissions.

LITERATURE REVIEW:

- Another paper by Tangzhi, Jue, Xingliang, Ting Shang analyzed a model in there paper that a multilayered hybrid version built on an analytic hierarchy process.
- Wi-Fi probe technology was used to capture the data, which was then grouped using the K-means method. The entropy - based approach to improve the evaluation of passenger departure



METHODOLOGY:

- The proposed system is based on the regeneration of all (or a subset of all) viable sailing paths, which are then fed into the model as input.
- In this study, two techniques are followed; Designing partial routes and customizing sailing speed.
- As there are several manufacturing facilities at a port, it might be advantageous to establish more advanced route topologies in which several ports could be met again.
- In the MIP paradigm, we generate a component for every combination of paths and boat types, therefore we dramatically minimize the amount of parameters when contrasted to producing all conveyor belt pathways.

METHODOLOGY:

- In this approach, the fastest speed is not selected at all, however all velocity options are utilized in the price-optimization approach. However, up to 69% of flights are only conducted at the lowest latency.
- Velocity as a weighting factor may have an impact upon the most cost-effective layout of the multi-modal transmission systems. Thus, the choice of traveling pace has a significant impact on fuel use and expense.
- Thus, we have opted to use a range of distinct velocity alternatives among the lowest and highest operational rate in order to calculate the boat's fuel usage.
- As a result, we present partial routes in this study to efficiently describe highly generic route architectures.

ANALYSIS:

- Some of the world's biggest ports, notably Singapore, Rotterdam and Hamburg, are using the same AI tools to improve business operations.
- The results of simple vehicle transportation are then contrasted before assessing the impact of speed augmentation.
- The data is collected and processed after that, AI is used to spot patterns in the logistics chain and offer detailed prediction times of when vessels, lorries and containers will reach terminals.
- The key distinction among the two methods is that while limiting emissions, a greater proportion of multi-modal transportation (coastal transport) is chosen, 72% versus 65%.
- Other significant distinction among the two strategies is that, predictably, in the emission-optimal strategy, virtually all picked journeys (98%) are flown at the slowest possible pace to decrease fuel utilization.

RESULTS & ANALYSIS:

- While reducing emissions, the integrated price in target function increased by a very tiny constant to guarantee that the option with the least price is picked across all alternatives that are optimum in terms of emissions
- As indicated in Figure 1 (a), the overall price of the approach when expenses are minimized is 310.71 million USD, but the price is approximately 5% more once emissions are minimized.

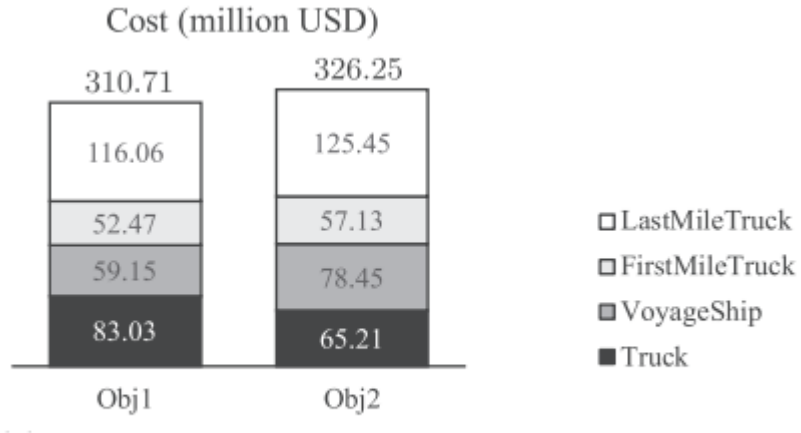


Figure 1 (a): Comparing solutions from minimizing cost [7]

RESULTS & ANALYSIS:

- As shown in Figure 1 (b), it is seen that limiting emissions reduces CO2 emissions by just around 2.6% when compared to minimizing costs (i.e. 412.98 million kg vs. 423.80 million kg).
- This can be observed that adopting partial pathways results in cost and emanation reductions. The main distinction is that when partial routes are included, multimodal transmission comprises a bigger percentage of overall transportation, 65.4% vs. 62.1%.

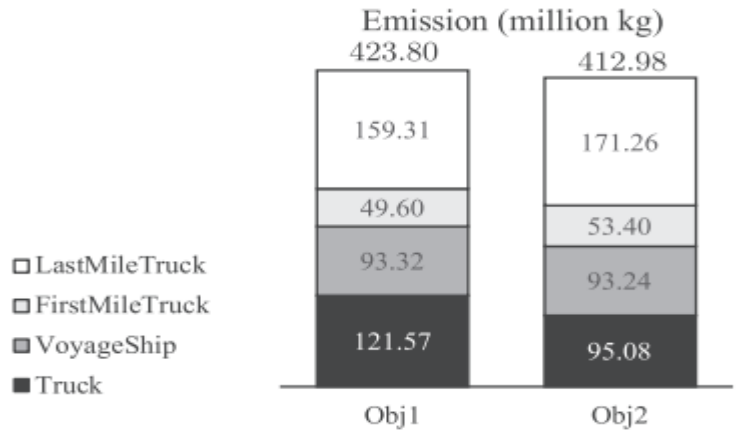


Figure 1 (b): Comparing solutions from minimizing emanations [7]

RESULTS & ANALYSIS:

- Figure 3 depicts the impact of speed enhancement. As a result, there has been a far larger shift in releases, from 437 M kilogram to 422 M kilogram, or a 3.0% decrease in CO2 emission levels. If emanation is decreased, the emission reduction from increased speed is around 4.0% (413 M kilogram vs. 432 M kilogram), however the price rises by roughly 3.9%. (327 vs 315.15 million dollars).

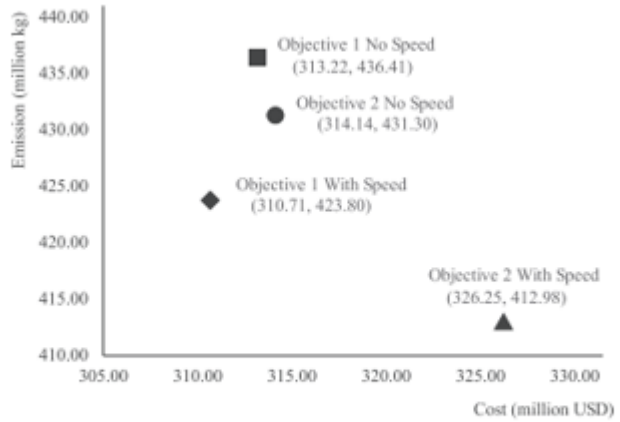


Figure 3: Comparison of costs and emissions with and without speed optimization

CASE STUDY:

- Recently, Awake.AI Oy, a native Finnish AI company concentrating on maritime logistics, announced that it had managed to win the EU-wide bid for the suggested 'time data' service for port authorities and officials, also known as the new 'Port Call Time Stamp and Estimation Service.

- The software application is being implemented by Fintraffic's Vessel Traffic Services division, a government firm that oversees Finnish land, air, and ocean traffic through better forecasting.

CASE STUDY:

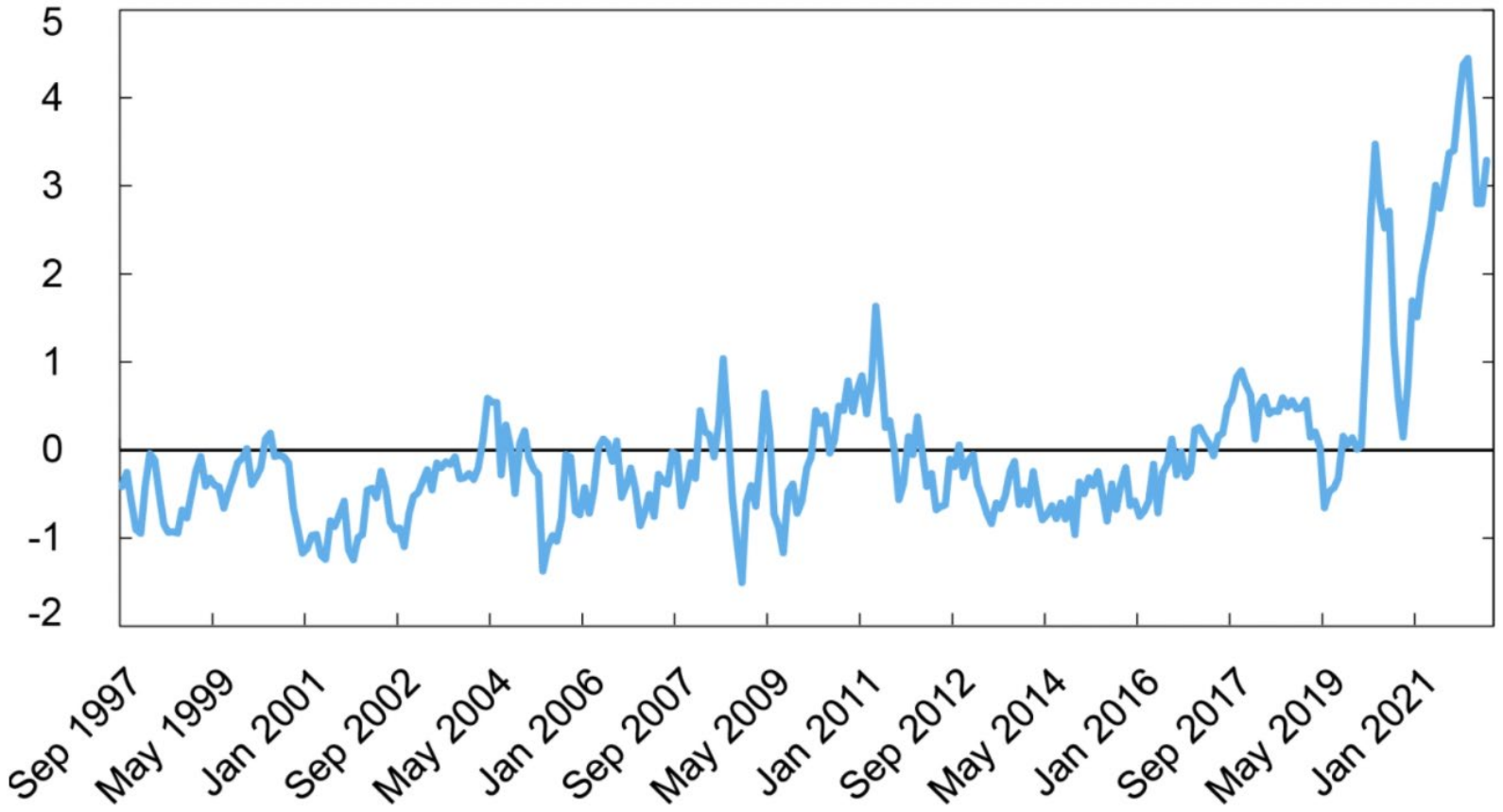
- Traficcom has been working in Finland to improve maritime logistics. All forecasts will be analyzed using machine learning and past AIS (Automatic Identification System) messages, which are the industry standard in commercial shipping.

- This system is set to radically improve operations in one of that nation's most important industries and is set to do everything from boost the efficiency of port operators' routine activities, speed up automation, help to anticipate exceptional circumstances and reduce environmental emissions.

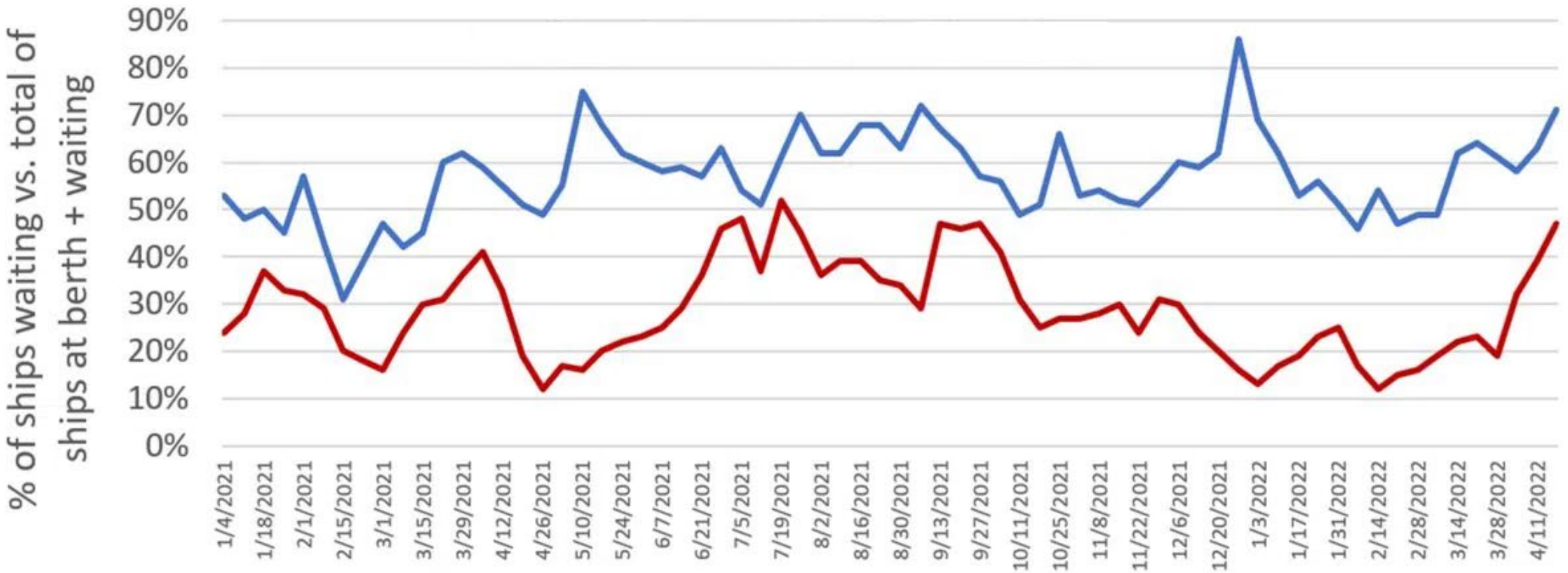
CASE STUDY:

- The move marks a significant global first for both AI in shipping and the slow push to digital supply chains. As Soininen predicts, “The importance of time data for shipping has been taken into account in both national transport system plans and the government’s decision in principle on the digitalization of logistics.

Finland Port: Ships Waiting



Finland Port: Ships Waiting before vs after partial implementation



Before Partial Implementation

After Partial Implementation

Expected Results After Complete Implementation

- Improve Efficiency
- Secure Working Conditions and Shipping
- Increase Productivity
- Improve Intermodal Traffic Coordination

- Increase port revenue.
- Allows for faster and better decision-making.
- Increase Security
- Streamline Customs Documents and Information

- Improved Resource Management
- System of Integrated Communications
- Implementing Just-in-Time Operations
- GPS-based traffic surveillance systems

CONCLUSION:

- Multi-modal transport utilizes many forms of transportation and could be an efficient method to mitigate the adverse ecological consequences of freight transit.
- This study considers a multi-modal transmission system construction challenge with the goal of optimizing economic and ecological advantages. We suggested a novel mixed integer programming (MIP) paradigm that determines the ideal system architecture.
- As a result, the model is expanded to encompass more generic route structures that become important when there are several loading ports.

Case Study Reference:

- Flood, G. (2021). *Case Study: Finland takes a big step to digital shipping with a new national machine learning system*. [online] Rockingrobots. Available at: https://www.rockingrobots.com/case-study-finland-takes-a-big-step-to-digital-shipping-with-a-new-national-machine-learning-system/ [Accessed 9 Sep. 2022].