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Research Article

Seatsure

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Abstract: *Container handling safety is important in ensuring that no accidents, damage to cargo, monetary losses or personal injuries occur in the transportation and logistics industry. Some of the key safety problems are usually caused by poor twistlock engagement, human error and poor verification processes in the preparation of the transit. The authors innovate SeatSure which is a highly reliable and affordable mechanical verification system that can help ensure the safety of containers and the effectiveness of the transportation process through trailer chassis. Once a container is placed onto a trailer, the operator secures the twistlocks in the traditional manual way. As soon as the locks engage, SeatSure's mechanical verification indicators detect their exact positioning and send a status signal directly to a visual dashboard. When every locking point across the transit setup is correctly secured, the control panel displays four green lights to show it is safe to drive. However, if any lock fails to engage properly, a red light immediately alerts the driver to the issue. SeatSure streamlines pre-departure safety checks, dramatically saving time, eliminating human oversight, and preventing dangerous highway accidents caused by unsecured containers. Because it uses a simple, reliable mechanical design rather than complex electronics, it keeps long-term maintenance costs very low. Beyond logistics efficiency, preventing accidents protects the surrounding environment from chemical spills, cargo debris, and traffic delays that increase fuel emissions. SeatSure holds strong commercial potential across the freight and transportation industries. Prime potential buyers include container trucking companies looking to improve fleet safety, port and terminal operators needing quick, error-free gate exits, and trailer manufacturers wanting to build built-in safety features into their chassis designs.*

1. INTRODUCTION

Due to the growing trend in the global trade and logistics chain, the proper securing and transportation of shipping containers is essential for any logistical operations. One of the major issues in this area is an improperly secured lock which often causes the tipping of the container, loss of cargo containers and financial losses, and even serious car accidents with fatal consequences for the driver and nearby people. The traditional method of verifying locks in terms of their security is very prone to human errors and fatigue.

There are some automated systems available but usually, they are costly and complicated to manage. To solve this problem, the authors propose a project, namely SeatSure; an affordable and easy-to-use mechanical verification system that allows automating the process of twistlock checking for shipping container chassis. This product fits perfectly into the existing workflow in the industry and provides a reliable indication of locking status for all twistlocks on each chassis.

2. METHODOLOGY

The development of SeatSure is a systematic, engineering-focused workflow designed to ensure reliability, ease of maintenance, and high operational visibility.

2.1 Mechanical Integration and Sensor Design

The system has a mechanical sensor system that is built into the trailer chassis twistlocks. When the container is mounted to the trailer, and the four twistlocks are engaged by the user, the mechanical sensors provide an accurate picture of where each twistlock is in its engagement state.

2.2 System Workflow

This operational process involves three stages of a safety procedure comprising spectrum selection that channels UV and IR rays to the edges of the window, edge coupling whereby PV strips located on the window's frame convert this channeled light into electricity, and smart grid whereby micro-inverters supply this electricity directly to the internal grid of the building.

2.3 Evaluation and Maintenance Framework

SeatSure is based on a sturdy mechanical construction along with visual signals, the product is highly durable despite adverse climatic and industrial conditions. The approach focuses on a cost-effective and user-friendly maintenance process whereby fleet maintenance staff can repair and maintain SeatSure without any technical assistance.

3. FINDINGS

Based on the analysis of the study consisting of 30 respondents, it shows a distribution of the sample into genders, where 33.3% of the respondents were male and 66.7% were females. High consistency is seen on the issues related to the safety hazards of maritime business, all the 30 respondents either agreed or strongly agreed that the unsafe locking of the container twistlock is hazardous.

The majority of participants highly appreciate the implementation of technology in order to increase the safety and effectiveness of the process. The feature of the visual display panel (where green colour means secured and red colour is unsecured) was rated by the participants on the average of 4.57 points out of 5. It means that the majority of the participants consider this feature to be a good and clear way to control the safety of the container.

The respondents are equally unanimous on mechanical and automated improvements. On average, the Seatsure mechanical linkage system received a rating of 4.37 out of 5, it was found to be effective in any dangerous situation. In addition, the importance of manually checking with automated processes by Seatsure which got an average score of 4.63 out of 5.

According to the results obtained, a lot of the surveys accepted Seatsure as an innovation as a whole. 100 percent of the respondents agreed and strongly appreciated that Seatsure is a great and good innovation, indicating their high degree of trust in the innovation. This shows that there is an extremely high level of acceptability of the system, in other words, it can be regarded as a very feasible innovation.

4. DISCUSSION

4.1 Safety and Operational Impact

The technology presents a critical solution to the problem of risks associated with sea transportation and port logistics, such as the risk of containers becoming unstable in transit. With regard to operation, the automation process enhances the handling of ships onshore, minimizing the need for risky manual inspections.

4.2 Industry and Logistics Relevance

For the shipping and logistics industry, adoption of an automated twistlocks security system means that the process of container handling becomes smarter and more efficient. This is because the technology allows port operators and crew onboard to keep track of the security status of containers in real time by use of visual dashboards. From the economic perspective, the reduced risk of cargo loss and delays associated with manual inspections lead to minimized overhead costs.

5. CONCLUSION

The Seatsure system has proven itself to be an excellent example of the effective integration of mechanical engineering and intelligent safety monitoring technologies. Having received high marks in such categories as visibility, mechanical reliability of the connection, and acceptance of the innovation as a whole, the project is meeting all requirements imposed by contemporary shipyard and container handling industries. The automated process ensures safety and efficiency for the future, aligning perfectly with the goals of the modern industry. Future directions will include large-scale pilot implementations of the system on commercial ships and terminals.

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