INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	Dp Containers	**Date Submitted**	*10/17/2023*
Project Title	Design of an Internal Locking Device for A Shipping Container (DP_LOCK)	**Planned Starting Semester**	*Spring 2024*

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	1
Computer	1	Systems	

Company and Project Overview:

Dp Containers has been in business for 27 years. They specialize in Selling and Renting Shipping Containers. The containers can be standard 20 ft, 40 ft and 40 ft high cube sizes. In addition to containers and storage space, DP designs and sells container modifications that facilitate non-standard usages like restaurant kiosks, offices and homes. Modification examples include such features as roll-up doors, man doors, custom painting, windows/skylights and racks.

Containers are a critical part of the global economy as they are one of the main means for transporting goods around the world. There are 4500 Ports around the world, 20 million containers on ships at any given time and 50 million in the global pool. Container break-ins are becoming increasingly frequent with millions of dollars in losses being experienced. External locks are quickly cut off with inexpensive bolt cutters. An example of this was documented in a recent news article from The Guardian:

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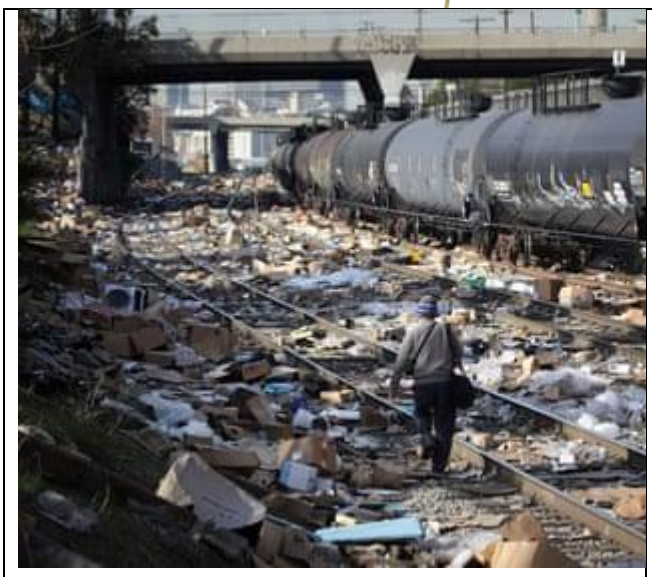

Newly released photos and videos showing train tracks littered with discarded boxes have cast fresh attention on the theft of packages from cargo containers crossing through Los Angeles in recent months.

On tracks near downtown Los Angeles, a team from Agence-France Presse on Friday found packages with labels of most major US mail order and courier companies. Reporters from CBSLA on Thursday found boxes from retailers including Amazon, REI and others. CBSLA reported that Union Pacific, the railroad company operating the cargo trains, had cleaned up the area of tracks where the boxes were found three months ago and again about 30 days ago.

In a December letter to Los Angeles county district attorney George Gascon, Union Pacific said it had experienced an over 160% increase in criminal rail theft in Los Angeles county since December 2020 and that on average, more than 90 containers were compromised each day. In several months during that period, the increase from the previous year surpassed 200%, according to the company. For the month of October 2021, it estimated the increase to be over 356% compared to the year before.

In the letter, Union Pacific said it has stepped up the number of Union Pacific special agents on patrol, and was exploring the use of tools like drones, specialized fencing and trespass detection systems.

DP has a unique understanding of the container theft issue based on over two decades of experience in the business and has developed and received 2 United States Patents on Container Security. DP's prior patented solutions worked but were very expensive. The expense is what prevented widespread adoption. With little progress in container security, and increasing problems with theft, DP Containers believes improvements in container security are needed and that is the focus of this project. Based on the advancement of technology, DP would like a student team to revisit container security designs and try to develop a lower cost point product that delivers the security needed.

Project Requirements:

A container passes through many hands. That makes the logistics of security more complicated. Consider the following example which is typical of a container transport cycle:

Hewlett-Packard (HP) Company applies the Locking Device and ships $10 million dollars worth of computers from Palo Alto California to Jamaica. The computers belonging to 1) HP, are loaded into a container that belongs to 2) JP Morgan Chase, 3) JB Hunt Trucking then transports the container to 4) Union Pacific Railroad, who transports the container to 5) Maersk Ship who crosses the ocean to Jamaica, where 6) Kingston Trucking Jamaica transports to 7) Lloyd's Department Store Jamaica, where the locking device is removed.

The lock to be designed in this project will have several levels of security that can be added based on the application and use of the device.

1. The Locking device needs to be covert, placed on the inside of the container, not visible from the outside of the container and completely waterproof.
2. The device needs to be "Applied" to the container, "Not installed". The reasoning is, the container may belong to one company and the locking device belong to another company. The lock would need to secure the door during the journey and be removed at the end of the journey. No drilling or modifications to the container. The device needs to be easily installed and easily removed and mobile after use.
3. The lock is desired to cost <$250
4. The device needs to get back to the owner of the lock after providing its intended use for a

customer. Questions to consider for the design: How does the owner of the Lock get the Lock back to the United States to rent or sale again to another customer? Could the cost be low enough to be disposable?

5. The lock is to be opened at the destination via an external mobile phone connecting wirelessly to the lock with password protocols.
6. Power: The lock should have on-board power required to operate at the destination after a 6-month journey. If the power has gone dead, there must be a method of wirelessly charging the lock from the outside of the door similarly to how wireless phone charging works.
7. Contents of Container: The lock needs to be able to download a manifest and read from a common phone from authorized users. Also, Store point of origin, destination, and time stamp of a breach (if a breach of the lock occurs).
8. If a breach has taken place from time of loading to time of unloading, the device must record the time of the breach of the lock, so when it is later connected to the phone, it reports this time and if possible, the location as well.

Expected Deliverables/Results:

Have a proof-of-concept design prototype that delivers the capability described above.

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Interest in mobile phone applications
- May require travel to the Company's location (Spartanburg, SC)