anyware robotics
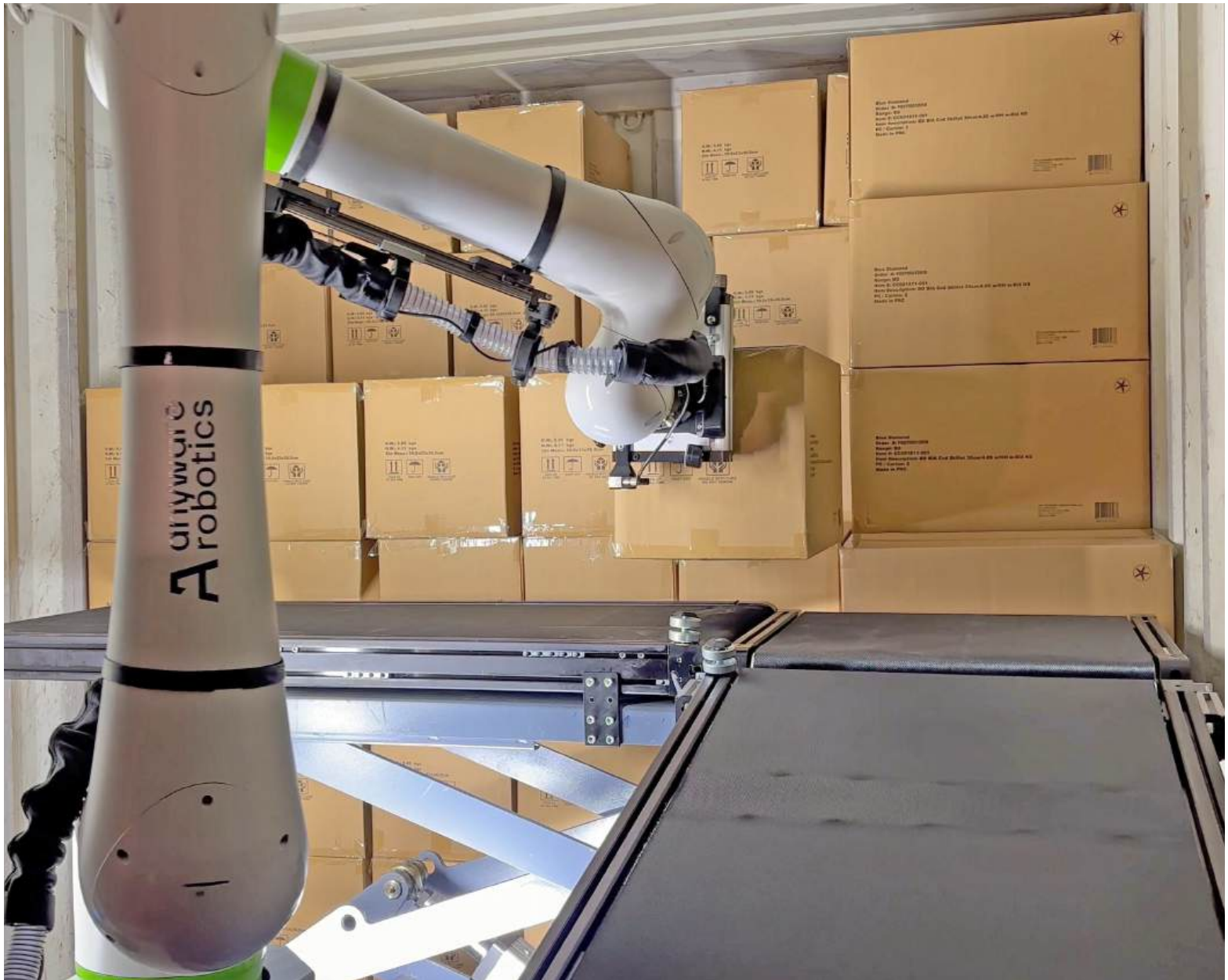
Using robots to maximize throughput and reliability in container and truck unloading

WHITEPAPER

Overview

Receiving docks are an essential component of the supply chain and are in import deconsolidation and transload facilities, warehouses, and distribution centers. Boxes in containers and trucks at these receiving docks need to be unloaded efficiently, safely, and rapidly.

Currently, inbound operations face intense challenges. Many unloading jobs remain open as labor turnover rates skyrocket. Moreover, downstream automation means that the receiving dock needs to unload faster and handle more complexity than ever before. Modernization of the receiving process via automation is critical for companies to keep up with the demand of their customers in a competitive market.

Anyware Robotics is developing multi-purpose mobile robots equipped with its proprietary embodied AI. Pixmo, the company's first robot, unloads hassle from warehouse operations. The initial focus of the versatile AI-powered Pixmo is to autonomously unload boxes in containers and trucks more safely, cost-effectively, and reliably – and release humans from that back-breaking and injury-prone work. Pixmo reliably achieves a throughput of up to 1000 boxes per hour and a box weight capacity of up to an industry-leading 65 pounds.

Today's shifted consumer expectations

Consumer fulfillment expectations have been permanently shifted by Amazon and other major retailers. People expect more choice and faster service. This drives the need for increasing item counts and fulfillment speed, all of which leads to growing supply chain complexity.

To compete, fulfillment services and retailers need to find ways to deal with these new operational challenges or they will get left behind. The complexities start on the receiving dock, where companies are being challenged to find ways to increase efficiency and throughput of floor-loaded containers, all while maintaining the health and safety of their employees.

Safety and turnover of receiving dock employees

The safety of receiving dock employees is a serious concern. OSHA estimates that 25% of all warehouse-related injuries occur on the receiving dock, with hundreds more near misses.[1] The injuries can be slips or trips due to the elevation change when entering and exiting containers, musculoskeletal injuries due to overuse, or forklift related accidents. There is also the risk of falling cargo, especially when the container door is first opened.[2]

Inside the container or trailer, working temperatures can range from 10°f to 125°f [3] depending on outdoor temperatures. All of this leads to turnover in unloading positions that exceeds 100%[4] annually, drastically above the estimated 41% turnover rate elsewhere in the warehouse.

Due to all of this, the warehouse labor pool is shrinking. Moreover, absenteeism is on the rise, wage requirements are increasing, and training requirements are growing due to increasing operational complexity.

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Some warehouses have turned to lumper services[5] to augment or replace their unloading operations. These services, which are essentially extra human laborers, are usually expensive and charge a per container rate between $250-$700. They also add challenges, such as managing consistency and trying to control external employees in your facility.

It is clear that to compete on the receiving dock, businesses need to evolve past "business as usual." But what has prevented operations from taking this step?

The surprising complexity of unloading containers

Once a container is packed at its point of origin, it is subjected to forces that can cause issues upon opening and unloading on arrival. Goods that were initially loaded in an orderly manner end up shifting, creating unstable walls, jammed boxes, and other tricky layouts. Boxes may be poor quality, mis-taped, leaking, or even broken, leading to potential slip scenarios or situations that require cleaning of the container prior to unloading.

Receiving operations need to be flexible to handle all the above variability, as well as box orientation, size, number of SKUs, carton sizing, and packaging quality.

For any robotic solution, this situation presents a complex problem of perception, motion planning, and task planning.

Given the variability, traditional pre-programmed automation quickly stretches to its limits, unable to cope with the unpredictable situations presented. To solve this problem requires robot systems that can learn and adapt for various scenarios.

How Anyware Robotics Pixmo addresses these challenges

The goal of Anyware Robotics is to create efficient and safe mobile robots, powered by embodied AI, to handle highly repetitive, high-reach, and heavy tasks with a single robot form factor. Pixmo, the company's first robot, unloads hassle from warehouse operations. The initial focus of the versatile AI-powered Pixmo is to autonomously unload boxes in containers and trucks more safely, cost-effectively, and reliably.

Pixmo combines an autonomous mobile robot (AMR) base, a cobot arm with six degrees of freedom, vacuum-powered end effector designed for box handling, and AI-powered perception and motion planning systems.

Anyware Robotics supplies a patent-pending conveyor add-on for companies using Pixmo specifically for box unloading tasks. Throughput is greatly enhanced because the Pixmo robot arm simply "pulls" to the conveyor, minimizing the distance the robot arm needs to travel to unload each box.

In the past, picking boxes in the top two layers of a truck or container challenged vacuum based grippers because they had to grasp boxes from the side.

Boxes with longer depth (or aspect) ratios have more distant centers of gravity, and when side picking, this force is enough to shear the box off the gripper as it moves through the air.

Now with the conveyor add-on, the box weight is transferred from the gripper to the conveyor which increases unloading speed and reliability. The robot reliably achieves a throughput of twice the human rate and a box weight capacity of an industry-leading 60 pounds.

Safety is a key element of the Anyware Robotics solution. Pixmo is the first and only robot in the category that uses a force-sensing cobot arm for box handling. Unlike industrial arms, if Pixmo senses any unexpected collision it will immediately stop the arm movement, creating a safer environment. In addition to this "passive" safety feature, a safety-rated "active" system reads and assesses the surrounding environment. The active system uses LiDAR and cameras, all of which enable the robots to work in environments with humans nearby.

Pixmo uses embodied AI to handle container complexity

Pixmo is powered by proprietary embodied AI that combines the latest perception algorithms with learning-based motion planning to intelligently interact with and manipulate its surroundings. In simple terms, by learning through simulated environments, Pixmo understands the real-world environment and the relationships between objects, enabling smarter, more successful strategies for picking and manipulating boxes.

When unloading containers, it can easily adapt to the complexity of shifting boxes during transit, box orientation, box size, number of SKUs, carton sizing, and packaging quality.

Pixmo includes a generative AI pipeline which is designed to quickly build the robot's understanding of its environment so it rapidly adapts to any situation and makes successful picks. When there is any kind of box pick issue (say an overlapping label), the scene is captured and processed using generative AI techniques. This generates hundreds of thousands of variations of box layouts and conditions enabling Pixmo to quickly be ready for a myriad of future scenarios. This use of AI means less downtime, if any, for Pixmo. It also is a major advantage over other systems out there that require experiencing thousands of issues for their models to learn.

The use of this highly advanced AI for adaptability means Pixmo can be quickly deployed on-site and learn and adjust on the fly. This leads to optimized precision, productivity, and safety in each specific setting.

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Fast deployment of Pixmo and future versatility

Pixmo robots do not require costly software integrations, and only need minimal hardware infrastructure to be integrated into the warehouse environment.

The robots can be deployed without bolts in the ground and process changes. It does not require redesigning a completed warehouse around costly and infrastructure-heavy automation. Avoiding this capital investment enables companies to invest in other parts of their business.

Pixmo is designed to navigate through the warehouse. Its mobile base has the footprint of a pallet, and it can move in any direction to create the best handling pose for the robot arm for each specific application.

The embodied AI capabilities in Pixmo will expand with over-the-air software releases for various applications and, combined with its flexible form factor, will enable the robot to be used for a variety of other tasks within the warehouse. These tasks may include palletizing, depalletizing, case picking, container loading, and more. This versatility minimizes any robot idle time while augmenting labor throughout the warehouse.

In summary

Warehousing operations need automation to keep up, and surpass, their competitors. The task of unloading boxes from containers is one of the most brutal jobs in the warehouse and they are often the toughest jobs to fill. With Pixmo, companies can effectively handle the receiving dock challenges including employee safety, labor availability, and operational stability.

If you are interested in learning more, please visit the Anyware Robotics website at www.anyware-robotics.com Or reach out to the team at info@anyware-robotics.com
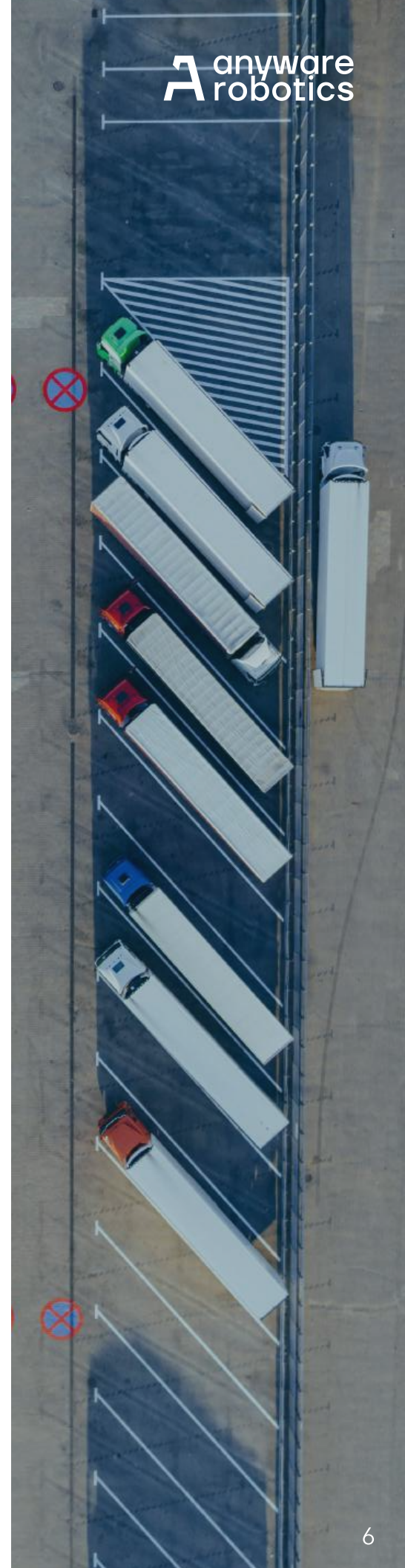
About Anyware Robotics

Anyware Robotics is developing multi-purpose mobile robots, equipped with its proprietary embodied AI, for several labor-intensive industries. Pixmo, the company's first robot, unloads hassle from warehouse operations. The initial focus of the versatile robot is to autonomously unload boxes in containers and trucks more safely, cost-effectively, and reliably. In the future, with planned over-the-air updates, its capabilities may include palletizing, depalletizing, case picking, container loading, and more. Anyware Robotics was founded in January 2023 by four AI and robotics industry veterans and is based in Fremont, CA. More information at: www.anyware-robotics.com

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