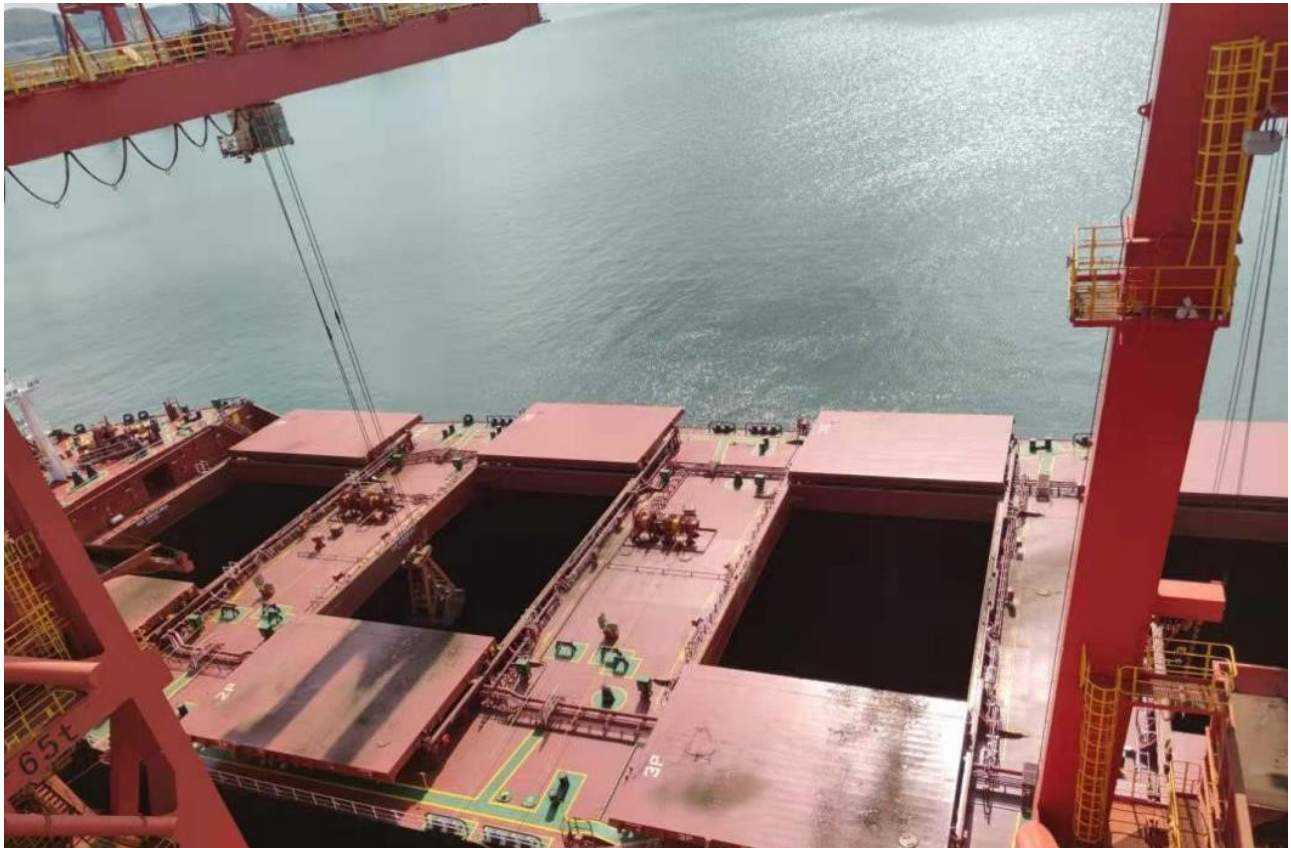


Full Automation of the Shandong Port Using Quanergy's LiDAR Solutions



Port automation is only seen in about 3% of the world's port terminals, even though it provides significant advantages to high-volume ports. Automation increases operational efficiency and safety, reduces labor costs and employee turnover, reduces carbon emissions, and increases ROI. Standard practices don't allow for full automation without special equipment because precise evaluation of the stockpile is required. LiDAR solutions from Quanergy provide the smart sensing port terminals need to get automated and drive productivity.

Challenges

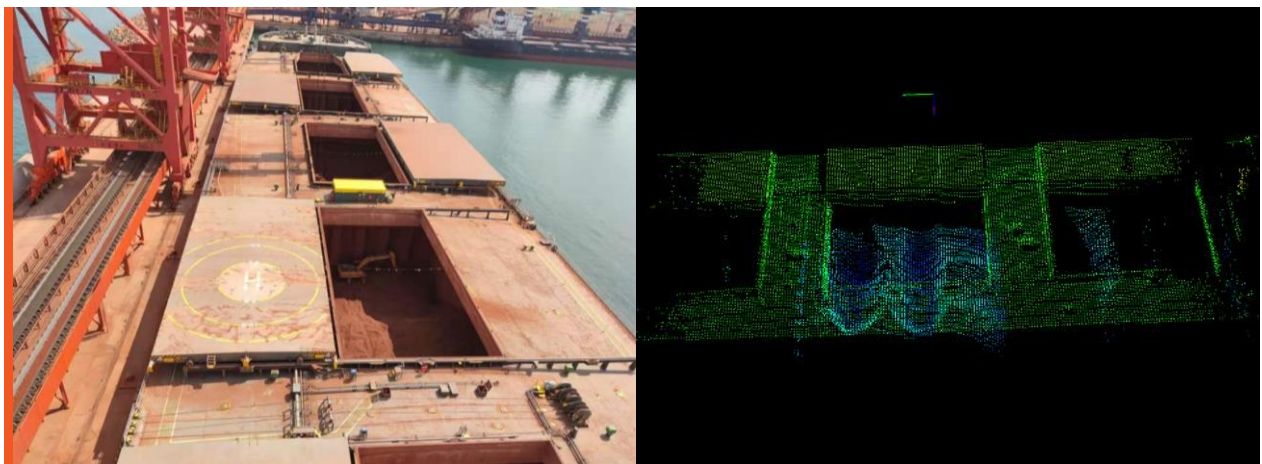
The challenges that Shandong Port Group's bulk terminal was facing were extensive but unfortunately are experienced by most of the bulk port terminals around the world. It's impossible to clearly and intuitively observe the shape of the stockpile, which is needed for most automation operations. Without LiDAR, it was impossible to know the exact boundary of the cabin, so there was no way to define an accurate safe operation zone. Without being able to determine the

coordinates of a specific point in the stockpile, grab buckets couldn't be moved to the desired location. The cabin size couldn't be determined fast enough to infer the number of operation rows and grasping time of a single row or layer. Soft-landing of the grab couldn't be achieved without the precise height of the material stockpile.

Before contacting Quanergy and Shanghai Rays, the bulk terminals' unloading operations in Shandong Port would be carried out by manually setting the safe work area and relied on manual grabs by the operator. The traditional solution is not capable of supporting fully automatic unloading operations. It does not supply the coordinates of the cabin and stockpile accurately, provide a clear visual display of the operation area, ensure high-quality automatic operation in harsh environments, or save the time before the automatic unloading starts.

Solution

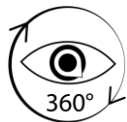
Shanghai Rays chose Quanergy's LiDAR solutions for their customer, Shandong Port Group's bulk terminal in order to obtain the coordinates of the cabin and stockpile, as well as specific locations in the stockpile. With those coordinates, they're able to define the safe operation zone, move the grab bucket to the desired location, infer the number of operation rows, and estimate the grasping times of a single row or layer. They now have a clear, visual display of the operation area that allows for full unloading automation, as well as soft-landing. Before choosing Quanergy as their LiDAR provider, Shanghai Rays evaluated other LiDAR solutions. Three primary differences helped them determine that Quanergy's options and expertise were more appropriate and better performing than their competitors'.



M-Series LiDAR sensor generate a 3D point cloud to visualize materials on a ship hatch, and Shanghai Rays software uses this data to automatically control the grip that unloads the material

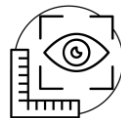


Quanergy M-series 3D LiDAR sensor mounted on a pitch control equipment with a protective cover



Wider Scanning Range

Quanergy's LiDAR solution offers a 360° scanning range that covers a larger area with fewer sensors.



Denser Point Cloud

The denser point cloud enables higher resolution that provides more data and more accurate visualization.



3D Object Visualization

By visualizing objects and stockpile in 3D, operators are better equipped to increase productivity.

Conclusion

The successful port automation of Shandong Port enabled unprecedented cost and loss reductions. With a clearly-defined safe operation zone, they were able to eliminate more than 90% of work-related accidents, which has lowered the risk of losses through employee compensation, turnover, and productivity loss. Labor costs have been cut by 25% and they have achieved a 20% increase in productivity compared to manual operation. Through these improvements, the Quanergy LiDAR system paid for itself in less than three months of operation and continues to facilitate increased profits for this high-volume bulk terminal.