



## AR-Based Smart Warehousing System

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Warehouse dependency is rapidly increasing around the world, with demand rising every day. From agriculture to enterprise industries, warehouses play a vital role in the storage and global distribution of products across applications, enabling efficient order fulfillment from vendor to customer. With current pandemic conditions driving the rapid distribution of COVID-19 vaccines, warehouses have an especially important role to play in effective logistics. Due to the rapid movement of the world towards digitalization and e-commerce on the rise, retailers are now investing heavily in warehouses to store products before distribution. Warehouses also play a key role in the growth of e-commerce, as they connect various locations and make scaling possible. Today, a customer can order a product from anywhere in the world and the growth of warehouse utilization enables safer and faster delivery.



**Due to this increased dependency on warehouses for global network connection and the increase in number of products in demand every day, there is a need to improve the operational efficiency within warehouses.**

Warehouses need to be optimized, as they are the main departure point for global distribution, and any problem at the warehouse could lead to complete transaction failure. Therefore, warehouse operations systems need to be smarter and more effective.

There are various techniques that companies are adopting to improve warehouse performance. Warehouses are increasingly using drones, robots, and other technology to manage warehouse operations.

**Specifically, augmented reality and virtual reality technology is gaining wider adoption and is becoming a very useful tool in various industries. Many e-commerce companies, including IKEA, are developing AR/VR technologies to manage their full scope of products in the warehouse, to help improve the user experience and expedite returns from vendors and customers effectively.**

Due to the huge number of products present in the warehouses, there is a need to further enhance the AR/VR-based warehouses, automating the solutions to solve existing challenges and improve efficiency. Currently, many warehouses are only producing AR content for experience purposes. For example, in the IKEA app, you can choose a chair and an AR object would be placed in the user's environment, helping the user choose the chair most suited to the room. In this way, the AR technologies are helping the users experience the products in the real world. But these solutions do not focus on improving warehouse operations. With the increase in range of products available, the user experiences of the products also vary, and creating the AR/VR content for all these products is a major challenge. Hence, the content creation needs to be automatic to make the warehouse smart and efficient.

A software solution that automates the AR content creation can solve the aforementioned challenges. This can be achieved by constructing a 3D object of every product and creating a database consisting of various details, including the location of the product and product features. This software solution can be used by both consumers and warehouse agents with different functionalities.

For consumers, if they find a product they like, they can click a product image and the application would convert the 2D images into a 3D model and then compare the model to the database. Based on the comparison, the user would be recommended similar products and be able to access the description of the product from the catalog. The 3D scan of each product can be converted to an AR object, which can be utilized by user to test it in their environment. For example, a lamp's 3D scan can be converted to AR object and users can check whether it suits their environment or not. Also, if they received the product and found some damage, the user can click the images, which would then be converted into a 3D model and matched with the product.



For the warehouse agents, the location details in the database can help the agent navigate through the warehouse while locating the product. If any repair work is needed, the agent can use the software to input the damage and predict the type of repair work needed. The system would then augment the repair's instructional video, which is collected during the content creation step. If a lamp has a broken bulb, for instance, the system would predict the damage and augment the video of how to replace the bulb by the user with the remote warehouse agent's help. As a result, the warehouses are made smarter and offer users an improved experience using AR technologies.

## Summary

Software solutions using automated AR technology can improve the efficiency of the warehouse as inventory increases incrementally. The solution can help to effectively create AR content for each and every product in the warehouse and store them in a database. This can help vendors build the application and empower users to interact with AR objects, created from 3D scans of 2D images, and experience the products in the real world. This solution could also help warehouses identify damaged products in a smarter way and provide instructions to the user for repair or replacement of the product.

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### About the authors

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Vivek has been working in research group of iX team for 2 years in the fields of Artificial Intelligence, Computer Vision, AR/VR technologies after graduating from NIT Jalandhar. His primary responsibility is to build innovative and cutting-edge solutions for iX.

Vivek has implemented various novel vision-based Intelligence solutions for which he received multiple publications, patents for it and actively contributed to the Machine Learning community by participating in multiple conferences.

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Gopichand Agnihotram has 14+ years of IT experience, working in machine learning and artificial intelligence areas. He is leading the research group in iX and responsible for building the new innovative solutions for iX.

Gopichand has published 25 research articles in International Journals and Conferences. He has filed more than 30 patents in USPTO among 10 are US granted patents. He is active member of ACM and IEEE for participating and chairing many conferences and workshops.



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