CUSTOMER CASE STUDY

> “If we miss an error during the materials assembly stage, it leads to delays in the final construction schedule. Our objective was to ensure we could catch every error by harnessing the power of ICT in the inspection of assemblies.”

Hiroaki Nishihara
Executive Director and Factory Manager
Oyama Factory, TOMOE Corporation

Augmented Reality (AR) boosts the efficiency of assembly inspection.

At a glance

Country: Japan
Industry: Manufacturing
Founded: 1917
Website: tomoe-corporation.co.jp/

Challenge

In order to minimize human error in measuring construction dimensions and angles, and minimize the risk of rework during construction, TOMOE developed a prototype system based on 3D CAD. However, this system was too complex for reliable use.

Solution

TOMOE partnered with Fujitsu for the digital co-creation of a tablet-based inspection system using digital imagery and augmented reality technology. Data is extracted from photos taken of construction elements, before being overlaid on solid model images drawn from 3D CAD data, allowing for immediate and accurate inspection on the tablet screen.

Benefit

- Inspection of components now takes 10% of the time required for visual inspection
- Faults are now accurately identified allowing early modifications during the materials assembly stage
- Ability to inspect large steel structures, which was previously not feasible

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Customer

Since its establishment in 1917, TOMOE Corporation (TOMOE) has been involved in the design, manufacture and implementation work on a vast array of buildings, steel towers, bridges and steel structures. The company has developed numerous proprietary construction-related technologies and won widespread acclaim for the technological prowess exhibited in a wide range of projects, including the evocative sail-like roof over the multipurpose commercial facility of Tokyo Station.

Products and services

- FUJITSU Digital Co-creation

Contributing to community advancement using proprietary construction-related technology

Since 2006, TOMOE has been a pioneer in promoting the use of ICT in the design process by employing 3D CAD and automated design solutions. Unfortunately, the task of checking that assemblies are produced exactly as designed was largely a manual operation, relying on visual inspection and measurement tools. Human error in measuring key dimensions or angles would increase the risk of misaligned components being delivered to the construction site.

"If we miss an error during the materials assembly stage, it leads to rework in subsequent stages and delays in the final construction schedule," explains Hiroaki Nishihara, Executive Director and Factory Manager, Oyama Factory, TOMOE Corporation. "Therefore, our objective was to enhance quality and ensure that we could catch every production error by using ICT in the inspection of assemblies."

TOMOE developed a proprietary technique for detecting misaligned components, which involved overlaying 3D CAD data on photographs of assemblies. A prototype system was developed, but the interface was too complex and many staff found this tool difficult to use.

In search of a resolution, TOMOE turned to Fujitsu – a partner for more than a decade in the area of CAD/CAM system implementation and operation. Fujitsu proposed the development of an assembly inspection system based on augmented reality (AR) technology.

Takeshi Yanagihara, Director of the Systems Promotion Department in the Development Division of TOMOE reflects, "We commenced joint development following Fujitsu's recommendation to deploy markerless AR technology. This approach provided better flexibility and was more user-friendly."

Instant inspection capability via tablet camera and user-friendly interface

The proof of concept for the AR-based assembly inspection system ran from December 2015 to June 2016. The target product for this trial was one of the company's leading offerings, known as the TOMOE UNITLAS, used in a diverse array of structures. The solution comprises steel balls and steel boards that are connected at intervals of between 30 and 100 centimeters. The assembly inspection system jointly developed by TOMOE and Fujitsu uses the camera in a tablet device to take photos of the components during the materials assembly process. Data for the linear elements is extracted from those photos and overlaid on solid model images drawn from the 3D CAD data, allowing for immediate inspection on the tablet screen.

"During the proof of concept we continually refined the system to more effectively detect simple linear images from the photos of materials combined in complex shapes," explains Takeshi Yanagihara.

Accurate error detection eliminates rework in later stages; system rollout to all factories being planned

Some of the key benefits of the assembly inspection system confirmed during the proof of concept included ease of use for all participants and a drastic reduction in inspection time. "The inspection of one component now takes only 2 to 3 minutes, which is about 10% of the time required for visual inspection – significantly boosting our productivity," comments Akihiro Domeki, Team Leader of the No. 2 Manufacturing Group in the Manufacturing Department at the Oyama Factory of TOMOE. "It is so easy to operate that even novices can pick it up very quickly. We currently have three staff at the Oyama Factory using this system, but plan to add two more so that we will have a team of five undertaking this inspection work."

As a result of implementing the AR-based assembly inspection system, production miscalculations and human errors are no longer an issue. All faults are now accurately identified allowing early modifications during the materials assembly stage and completely eliminating rework in later stages. Kazuo Matsumoto, Director of the Quality Management Department at the Oyama Factory of TOMOE notes, "We achieved our objectives of improving quality and avoiding the risk of causing delays in on-site assembly schedules. Furthermore, we have earned the trust and praise of facility owners and the prime contractors who place their orders with us."

After completing the proof of concept, quality was further enhanced by adding a pre-shipment product inspection stage made possible through the combined efforts of TOMOE and Fujitsu. Due to improvements in image processing capabilities the assembly inspection system can now also be used to inspect large steel structures.

The current scope will be expanded from the TOMOE UNITLAS product line to inspection of a wider range of assemblies in all its factories, to boost the manufacturing quality of structures with unique shapes that would otherwise be difficult to inspect.

Fujitsu will further strengthen its commitment to co-creation by continuing to support the operations of TOMOE, as the company pursues its activities that contribute to many facets of society.

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