An Approach to Human-Robot Collaborative Drilling & Fastening in Aerospace Final Assembly

Fixed-installation robots are not ready to adapt to changing workplace needs

Within the aerospace manufacturing industry, there has been an increase in the adoption of automated machinery to accomplish labor intensive tasks, yet production floors are filled with fixed-installation robots that are not able to adapt to changing needs. General-purpose method for workers to teach robots to accomplish tasks like bolt insertion is beneficial for workplace environments and can increase production and lessen the need for fixed-installation robots that lack adaptability.

New method teaches flexible manufacturing for dynamic aerospace workplaces

Researchers at the Georgia Institute of Technology have developed this new method that can directly label a workspace for flexible manufacturing, classify images via supervised learning data sets, and detect bolts for bolt insertion. This makes the approach applicable to any workspace environment, even if it has difficult and variable conditions such as an aerospace environment.

The invention is a new, collaborative, and adaptive robot-based approach to complete drilling and fastening tasks autonomously in an adaptable, unstructured environments using an expert demonstrator and human operator. The human trains the robot to autonomously complete tasks by defining its environment and demonstrating how to locate, classify, and insert fasteners into a fuselage using a camera and 3D sensor that surveys the area. While the system starts with no information, it can use online and offline learning techniques to develop a data bank of information to utilize throughout the insertion process.

Summary Bullets

- The invention is a new, collaborative, and adaptive robot-based approach to complete drilling and fastening tasks autonomously in an adaptable, unstructured environments using an expert demonstrator and human operator.
- The human trains the robot to autonomously complete tasks by defining its environment and demonstrating how to locate, classify, and insert fasteners into a fuselage using a camera and 3D sensor that surveys the area.

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Solution Advantages

• Does not require a pre-specified designated workspace.
• Workers can teach the workspace limits allowing for general purpose usage.
• Can learn and adapt to new tasks and environments by allowing workers to identify the types of holes and bolts needed, and then teach the type of insertion.
• Automates labor-intensive tasks, improving productivity.

Potential Commercial Applications

• Aircraft & aerospace manufacturing
• Ship manufacturing
• Fastening applications
• Robotic process automation
• Automation and flexible manufacturing
• Aeronautics & astronautics

Inventors

- Dr. Matthew Gombolay
  Anne and Alan Taetle Assistant Professor of Interactive Computing at the Georgia Institute of Technology

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