SPONSOR:

Ultradent Products, Inc.

Automation of Ultradent Tray Assembly

Ultradent Products, Inc. produces teeth whitening trays that are comprised of two pieces: a green outer plastic tray and a white inner tray. Ultradent previously assembled these two trays with an adhesive solution applied by an expensive robot working alongside several employees. In this project, BYU teamed up with Ultradent engineers to automate the entire tray assembly process.

BYU students were tasked with programming a FANUC M-1iA 0.5SL robot to accurately pick outer trays from a continuous conveyor belt and place them into fitted pallets on a stepped conveyor. Vacuum tooling was designed by the students to facilitate picking motion. The students were also given the assignment of designing and building a system to apply adhesive (provided by Ultradent) to these outer trays. To accomplish this, a system was designed in which two pneumatic cylinders alternated dipping custom brush-tipped tooling into adhesive reservoirs and subsequently applying the saturated brushes to an outer tray.

By the end of the project, students designed vacuum tooling capable of picking trays at a rate of 60 trays per minute and made valuable progress towards accurately picking from a moving conveyor belt. The team was also able to present the sponsor with a valid prototype for an adhesive application system with custom-designed brush tooling capable of consistently applying between 20 and 40 mg of adhesive at a process capability index value (C_{pk}) of 1.07. This system was capable of applying adhesive at a rate of 30 trays per minute.

Students integrated a FANUC M-1iA 0.5SL with a Cognex vision system and a PLC to pick outer trays from a continuously moving conveyor belt.

BYU CAPSTONE

YEAR

2014–15

TEAM

13: Echo

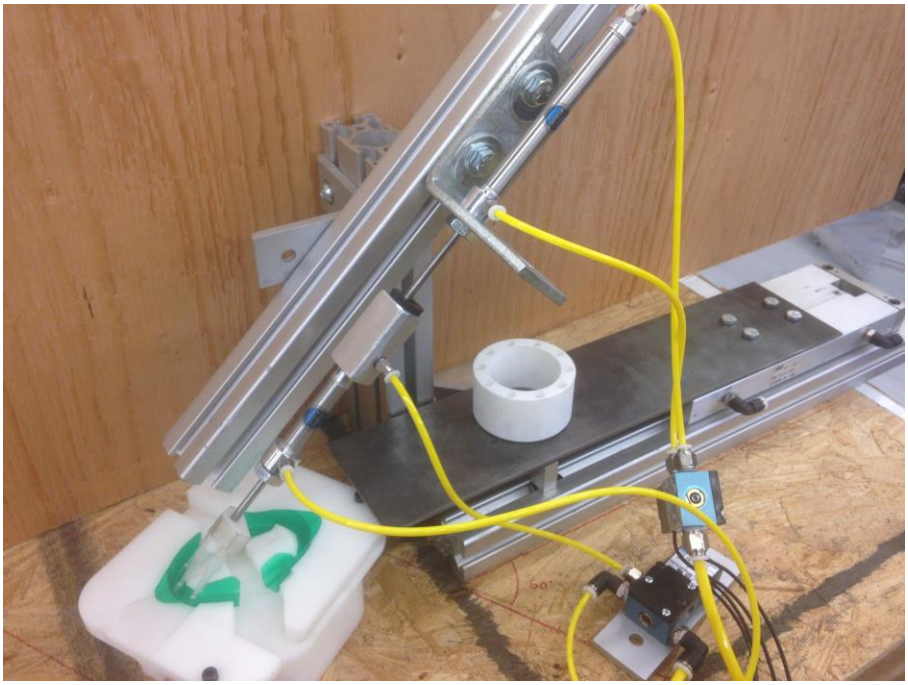
COACH

Rich Ziegler

STUDENTS

Daniel Bodily, Eric Boud, Jon Erickson, Joe Purdy, Jason Skouson

The design and engineering team. From left to right: Joe Purdy, Jason Skouson, Eric Boud, Jonathan Erickson, Daniel Bodily, Rich Ziegler



Adhesive application system. The system was able to consistently apply between 20 and 40 mg of adhesive (Goop) to each tray. The system was capable of applying adhesive at a rate of 30 cycles per minute.