Flexible Production Line Testing with Robotiq Adaptive Gripper and Force Torque Sensor

Products: 3-Finger Adaptive Gripper and Force Torque Sensor FT 150
Industry: Electrical Equipment Manufacturer
Application: Quality Testing System
Robot: 5-10Kg Collaborative Robot

A leading manufacturer of operator controls, non-contact sensors and safety devices has been working on new ways to improve their quality control and implement a robotic system to perform different in-line production tests. To do so, they have transformed their manufacturing lab, so that it can run their first automated quality testing cell. With a large portfolio of components and systems primarily for commercial vehicles, machine safety and level measurement, they have established the company's reputation over the years by promoting innovation, reliability and flexibility.

Application background

The joystick bases and control sticks are a main product group they manufacture and that must go through a wide variety of qualitative and quantitative test procedures. These are sold as a principle control device for vehicles and it is a critical component for their customers. The quality assurance team has to verify the conformance of the electronic and mechanical components before they get to final packaging. The quality control team in the past used to test their production manually which allowed the workers to adapt their verification tasks to dozens of different joystick models including custom configurations. The goal was to monitor the performance, full functionality and sensitivity of the joystick components. With everything being done manually, the company strove to minimize the work-in-progress at the different workstations, but didn't want to jeopardize its quality by implementing random sampling. Over the long term, they couldn't afford to assign more workers or increase the production pace which might lead to worker fatigue and increased mistakes. These non-value added operations within their quality control functions represented the perfect opportunity for their quality and engineering team to automate their testing through the addition of a robot and gripper.

KEY APPLICATION COMPONENTS

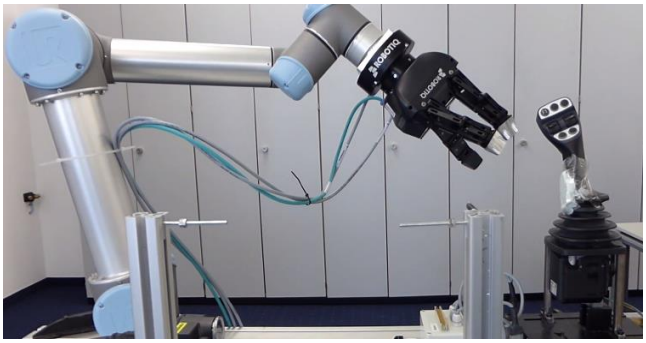
- Limited quality control capacity
- Critical non-value added tasks in production
- Lack of standardization in their work-in-progress for testing
- Time pressure that could lead to worker fatigue and mistakes

The Challenge

For quality assurance, an automated quality system seemed to be the perfect solution. The company could easily verify every single part and fully control the output of their quality workstations. However, the engineering team could easily have become lost among the different robot solutions available to achieve their goals. Their current manual processes are expensive, but they do provide a fast response feedback during production for any defective parts, as they want to keep the flexibility of the manual process. Ultimately, the whole process needs to be fast enough to fully monitor the wide variety of in-line testing tasks, as well as retain the capability of being proactive with preceding operations.

Cycle time is certainly a key factor directly affecting the output performance of the quality workstation,

but this becomes less critical once the quality control issues are addressed with an industrial robot. The time spent by the current workers to go through their physical testing on control sticks is generally split equally between the indexing time and the physical testing for every component. One of the most challenging parts of their project is to perform all of the quality tests with one end-of-arm solution using only one robot gripper with a force torque sensor. The gripper needs to be fully adaptive as it must apply repeatable forces on pushbuttons, as well as grab control sticks of different sizes and shapes throughout these quality control processes.



The automated quality control system is going to be susceptible to a great number of environmental factors on the shop floor. More specifically, electronic measuring devices like a force torque sensor can be affected by industrial noise. In this environment, a high signal-to-noise ratio sensor should be used to control the testing tasks. The engineers also expect to have the robot working with different controlled forces, valued under 100N. And the sensitivity feedback they are seeking should be measured from 3 different axes, so as not to limit the end-of-arm tool position when the force is applied.

The robot movements involved in the application require a standard precision range. The quality team would like to work with a robot repeatability of 0.1mm. The same general specs would apply to the gripper. As far as the robot and gripper speed are concerned, most of the cycle time is spent on the movements required to reach the parts and take up the right position for testing. The focus should be more on the robot speed specs than the gripper speed specs. The manufacturer also expected the robot to perform all the quality testing without workers. Nevertheless, they still prefer to give access to the robot environment to every worker without restriction. Thus, a workstation without protective guards would be a great advantage for the new production layout.

KEY APPLICATION CHALLENGES

- High mix of control stick sizes and shapes
- Advanced grasping and force sensing combined in one simple solution
- Adaptive Gripper for dexterous testing
- Force sensor featuring a high noise immunity
- Force control precision throughout the different force ranges under 100N

Approach - Solution

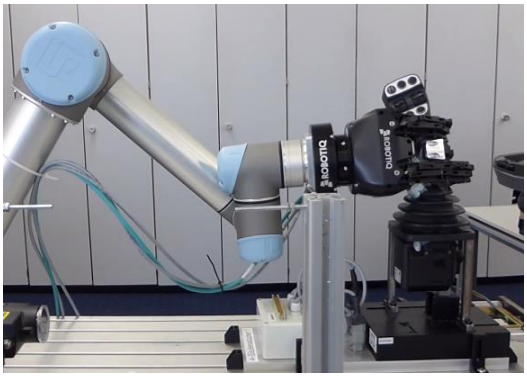
Beyond the solution, the quality control team knows that they need to keep the right balance between automated and manual quality assurance processes. It was decided to take time to integrate the new automated workstation in two phases. The first phase goal is to select the right robotic hardware and software and review the extensive list of tasks that would have to be done by the robot. The last phase would be the full integration of the automated system into the production line. The quality team expects to run their automated testing routines outside the production line for a while, while they are restructuring the quality control process. Once done, the integration and switch with the robot would be easier to organize along with job reassignments. Selecting a robot, a gripper and a sensor that are easy to use is an important criteria for the workers. In the end, the current quality control employees should be able to operate the robot system with ease.

Other key components for the solution are flexibility and precise control. They selected the 3-Finger Adaptive Gripper for its dexterous manipulation features offering unlimited grasping possibilities for their automated testing processes. They could have used the 2-Finger Gripper 85mm as well, but they determined that the 3-Finger Gripper was more versatile for their needs. They selected the digital force torque sensor, the FT 150, for its ease of use with a UR collaborative robot, but also due to the high quality, low-noise signal. They were confident that when they hit a pushbutton or moved the joystick with the Gripper, it would always perform as they had tuned it. For example, they knew they would get the right corresponding response just like musicians get the right sound with a precise stroke on a keyboard. They want a fast integration for the second phase of the project, so getting easily understandable software for their robotic hardware leaves more time to work on the quality control output rather than spending a lot of time programming every single task involved in their vigorous testing processes. Having the option to work with the Robotiq end-of-arm solution that is meant for collaborative robots helped the manufacturer to prove their design concept for an affordable in-line testing system using robots.

KEY APPLICATION SOLUTION

- Collaborative robot and workers in the same environment
- Robotiq bundle with 3-Finger Adaptive Gripper 85mm and FT 150 force sensor
- Robotiq Gripper and Sensor software developed for the UR controller
- Easy force monitoring with the digital FT 150 sensor from Robotiq
- Flexible end-of-arm tools to test buttons and control sticks

End Result – Success



The company is ready to take a huge step to improve their production costs, by tremendously reducing the manual tasks that are affecting their quality testing output rate. Their maxim "*Focus on people*" is reinforced by this solution through the use of a collaborative robot, a Robotiq Gripper and Robotiq FT sensor. They didn't expect to achieve such a smoothly integrated solution that can be easily operated by their workers. The end result for this owner-run family business will be to invest in the right solution which supports the responsibilities they feel for their employees. This easy-to-use solution allows the employees to take on a new role in robotic quality testing by keeping the focus on their own products and processes rather than spending several hundred hours on robotic development and analysis.

At the beginning of the project, the company needed to quickly validate the concept with a UR5 robot. They will continue to evaluate other collaborative robot options as they will need a longer reach and 10kg payload to fully meet all the required flexibility and specs that they are looking for. They are on track with one simple end-of-arm tool, the Robotiq Gripper and FT sensor that can be used for various quality testing tasks. Since the fast changing processes in their production influence their test sequences, they feel more confident with access to a Robotiq end-of-arm solution that can be easily adapted to their needs. And for instance, a similar setup becomes interesting for testing the life cycle of their products. Since the same workcell could run during the night or outside of work hours to perform different tests on the same products.

Much of the prospective effort is now focused on a complete panel checkout and product tracking systems, as they would like to integrate everything in their production processes. However, the design concept of using the collaborative robot and end-of-arm solution from Robotiq has proven to be able to

be quickly integrated and will offer greater ROI over time. In-line testing using robots will reduce human error and allow quality control operators to spend more time on high value tasks for production while doing less repetitive manual work.

KEY APPLICATION BENEFITS

- Easy-to-use Robotiq Gripper and FT sensor
- Off-the-shelf Robotiq solution for robot testing on finished goods
- Flexible automated quality system using a 3-Finger Adaptive Gripper
- High ROI for quality testing and manipulation

Would you like more information?

If you are interested in learning more about this application or other applications using the 3-Finger Adaptive Gripper and the Force Torque Sensor FT 150 contact us at: info@robotiq.com or at: 1 418-380-2788 ext.124