INDUSTRY 4.0 NETWORK SITE VISITS

Machine Learning and Vision Systems at Tait

Building Collaborative Intelligence into the assembly process

About Tait

Tait Communications is a global leader in designing and delivering critical communications solutions which are the right fit for a variety of industries including public safety agencies, government services, utilities, extractive industries and urban transport providers. Tait was founded in 1969 by Sir Angus Tait, who built an organisation focused on innovation and technical excellence. His catch cry 'the best is yet to come', continues to inspire a new generation of innovators at Tait.

Background

Tait develops, designs and manufactures a broad range of communication devices at its site in the garden city of Christchurch, New Zealand. These devices include handheld radios, many of which are purchased by organisations that operate in extreme and even potentially explosive environments, so quality is very important to Tait.

A key element of the handheld radios is the battery, and a number of these models are manufactured to be intrinsically safe, IP67 rated. The battery assembly process consists of placing the battery core into the cover, positioning the base over the cover and then ultrasonically welding the cover and base together to form the finished battery.

The design of the battery base is subtly asymmetrical which could lead to fitting and welding the base with the wrong orientation. Although downstream processes would detect the issue on the rare occasions that it occurred, once the welding was completed the battery could not be reworked and the defect resulted in scrap.

As a quick response to this issue, the production support teams implemented a number of physical changes to the process that included updating their visual SOPs, providing additional training for the assembly team, and making a change to the way the battery bases were presented to the team member who was working on that assembly station, in order to support correct assembly practices.

A request was also logged with the mechanical engineering team to design this potential assembly error out of the next iteration of the product.

As well as the above improvements, there was a desire to implement a more robust solution that would help to eliminate the chance of this issue occurring in the future.

Solution

A cross-functional team was set-up to implement a vision system at the battery weld station that could detect and check the correct orientation of the base before the ultrasonic welding happened.

A key requirement of the system was for it to be highly flexible and able to work with different battery configurations. To achieve this, Machine Learning was incorporated into the system to allow it to be trained to detect errors across different battery variants.

Taking a 'think big, start small, scale fast' approach, the team decided to begin by developing the system in-house and to use off the shelf items to get it up and running.

The system was set up per Figure 1 and retrofitted to their current welder.

A key part of the vision system involved training it on the range of battery variants, with good and no-good parts. A comprehensive set of images were used, covering 'good' and 'bad' examples of each battery type as well as images from when the welder was empty. These images were augmented during its training with random variations, helping the system to be resilient to slight movement and changes in lighting. If a battery is ever mistakenly classified, the system is retrained using the problematic image, so that it improves and learns over time.

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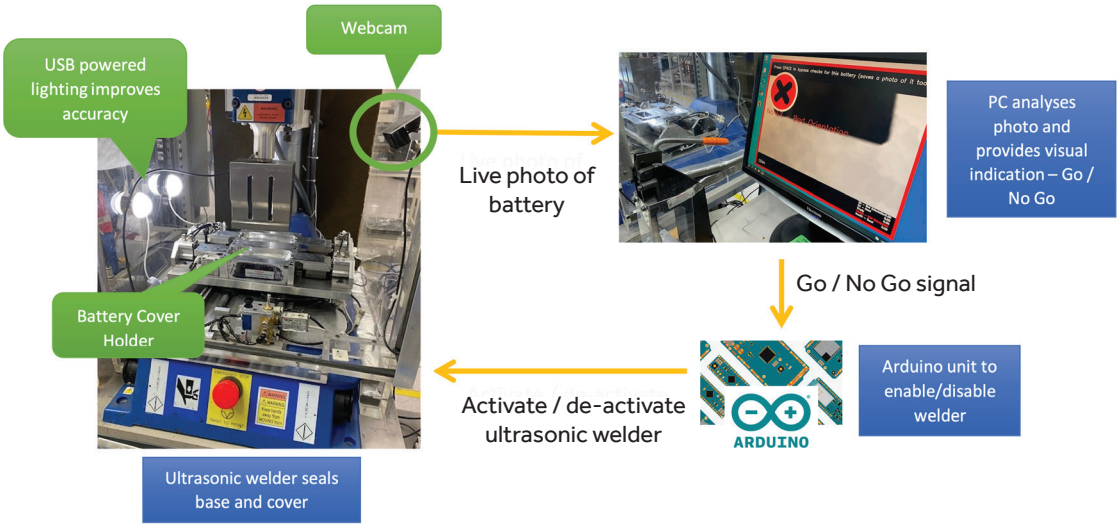
Figure 1



In practice, the vision system follows this process:

1. Capture image from webcam.
2. Process image to enhance sharpness and contrast.
3. Compare image to trained database of good and no-good assemblies.
4. Provide a visual indication showing good or no-good parts.
5. If a no-good part is detected, lock out the welding machine until error is corrected.
6. Capture image of no-good part and store in database for review.

Step 5 was not implemented until after a short trial period to confirm that the system was working and to limit disruption to the assembly line while any teething issues were resolved.

The system has been warmly received by the team working in the assembly area and defects in that area have fallen dramatically.

The next activity identified by the team is to scale the system up and into other areas, one of which could be to complement and then replace the visual checks that are conducted in their Surface Mount department.

Key benefits

- Removed the possibility for the battery case to be assembled in the wrong way, materially reducing the instances of this error without requiring a redesign of the case.
- Simplified the battery assembly process step. This now requires less training which makes it much easier to flex new team members into the position.
- Allowed an initial trial of the machine learning solution to provide proof of concept and help to gain buy-in from key stakeholders.

Takeaways

- Leveraging easily available, off the shelf hardware / equipment can help to get solutions up and running quickly.
- Building machine learning code into systems can ensure high flexibility and adaptability as products and requirements change.
- Implementing a trial in a clearly defined and scoped area can pave the way to bigger and more complex implementations of new technology.
- New tech systems such as this can easily be retrofitted to work with existing equipment and machinery.

About the site visits & Industry 4.0

The purpose of the Demonstration Network is to drive uptake of Industry 4.0 technologies among New Zealand manufacturers with the aim of increasing their productivity and global competitiveness. The Network of Site Visits (NSV) are part of the Industry 4.0 Demonstration Network, which also includes a mobile showcase and smart factory showing cutting-edge industry 4.0 technologies in action. The NSV takes selected companies through a fully-funded assessment process to help them accelerate their own journey towards Industry 4.0, and sees them share their knowledge with other manufacturers.

Further **questions?**

To find out more please contact the EMA or Frank Phillips at LMAC

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