The Deepsight inspection machine operates either stand-alone with manual product feed or in 2- to 4- machine pods with robot-assisted feeding.

EtherCAT-based servo technology in inspection machine for smart display devices

Fast and precise surface inspection of smart devices

The grading of cell phones and tablets according to cosmetic defects determines the necessary measures for refurbishment. In its inspection machine – for both new and used smart devices –, AI expert Griffyn Robotech uses PC-based control from Beckhoff for precise motion control in product handling. This enables the detection of micron-level surface defects in split seconds.

Griffyn Robotech, headquartered in Pune, India, specializes in visual inspection, robotics, and AI-based automation. With its solutions for industrial manufacturing and quality control, Griffyn caters to the automotive, telecom, pharmaceutical, FMCG, and machine tool industries.

Due to easy upgrade options, warranty and insurance cases, the reverse supply chain of smart display devices such as smartphones, tablet PCs, and wearable electronics is increasing day by day. Cosmetic inspection and grading is one of the crucial steps in processing returned devices because the detected optical flaws decide on the further disposition. Up to now, this has mostly been done by manual visual inspection. Although nothing beats the human eye for versatility, its repetitive accuracy and productivity are limited. In addition, millions of devices need to be inspected and graded before recirculating them in the forward supply chain every year.

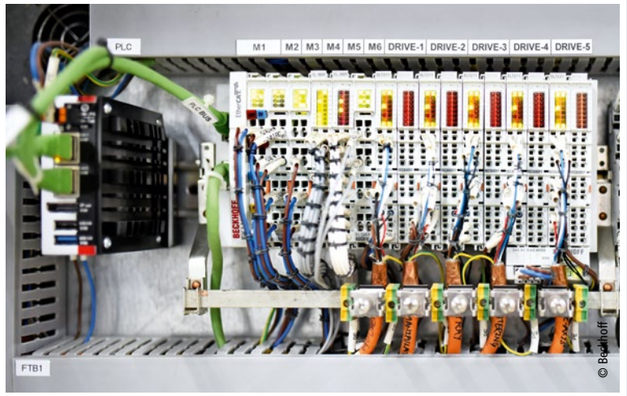
To meet the increasing demand in the reverse supply chain and eliminate the subjectivity of human grading, Griffyn Robotech launched the Deepsight Cosmetic Grading Machine (CGM). The patented vision system enables fast and accurate detection, measurement, and analysis of all surface defects with high repeatability. It intelligently identifies surface defects such as scratches while tolerating natural variations in complex patterns and surface textures, including glossy, shiny, or rough surfaces. It also takes into account significant differences in tolerances that apply to the make and model of the devices.

Efficient product handling reduces cycle times

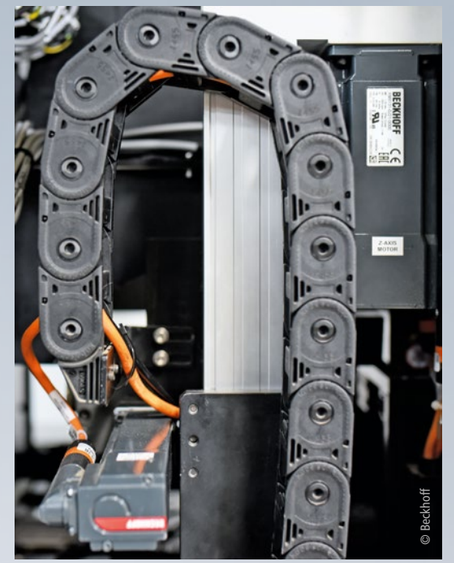
The machine uses a high-resolution camera sensor to determine any handheld device's "true" quality by capturing multiple images of all six sides of the device. However, the basis for accurate image capture is suitable product handling for flipping, turning and positioning the devices. For precise and fast motion control with accurate object orientation, Griffyn employs TwinCAT NC I motion control installed on the ultra-compact C6015 Industrial PC from Beckhoff. Combined with the AM81xx servomotors and EL7211 servomotor terminals, this enables complex multi-axis interpolated motion on a small footprint. Ultra-fast EtherCAT communication and sub-millisecond processing times reduce machine cycle times and boost throughput, according to Griffyn.

The captured images are put through Griffyn's proprietary deep learning algorithms to identify various surface defects such as scratches, cracks, dents, and discoloration. After analysis, the machine provides a detailed report that includes raw images and a processed image highlighting defects that may not be obvious to a human operator. While the human eye can detect visible scratches larger than 80 µm wide on the surface, the Deepsight machine identifies defects as small as 40 µm in width and 3 µm in depth. The report details the number of scratches on the device, the length of the most significant scratch, and the depth of the deepest scratch.

The machine provides out-of-the-box integration with supply chain management systems, where grading data drives downstream processes and the ultimate disposition of the device. Sub-standard smartphones with defects within acceptable ranges will be directed to a buff and polish process. For example, devices with scratches less than 15 µm deep can typically be buffed and polished, resulting in a flawless upgraded device. With its high-accuracy grading data, Deepsight is able to reliably determine whether devices are good candidates for simple refurbishment or need more intensive remanufacturing.



The ultra-compact C6015 Industrial PC and various EtherCAT Terminals including the EL7211 servomotor terminals enable an extremely compact control cabinet installation.



The AM81xx servomotors drive the five servo axes for turning and positioning the smart devices, and simplify installation and commissioning with the One Cable Technology (OCT).

Compact machine design as a goal

As Griffyn wanted to build a sleek, aesthetic-looking machine, they were looking for components that were as compact as possible. According to Griffyn, the compact drive technology from Beckhoff controlling the five servo axes, various EtherCAT Terminals and the ultra-compact C6015 Industrial PC really fit the bill. In addition, the One Cable Technology (OCT) of the drive components provided easy routing and installation. The TwinCAT software with its rich programming library, convenient user interface, and easy engineering and debugging made the design process very user-friendly. Excellent customer support from the local Beckhoff subsidiary facilitated the implementation.

The Deepsight cosmetic grading machine is available as a stand-alone device fed by a human operator or as a "pod" of two to four machines with automatic product feed by a robotic arm. With an inspection cycle of less than a minute, the machine has an output of four inspected devices per minute in the 4-machine pod configuration. Precise motion control technology from Beckhoff helps ensure 95% uptime of the machine with a throughput in the range of 200 devices per hour.

"Team Beckhoff understood our requirements well and gave clear assessment and recommendations of the options available with them for manufacturing Deepsight. We were impressed by the integrity, service, quality, and global customer support," says Mr. Ameya Kandalkar, Director of Griffyn Robotech.

More information:
www.phoenix.tech/griffyn
www.beckhoff.com/measurement
www.beckhoff.com/compact-drives