PHICS: Programmable Hardware Image Collection System

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The increasing scrutiny of supply chain of critical infrastructure has made the development of Hardware Bill of Materials (HBOMs) an appealing solution for identification of risk. However, HBOMs are not currently provided by vendors and manufacturers of control system equipment at large. The lack of first-party HBOMs has created a vacuum of quality supply chain data in the hardware that comprises key energy-critical infrastructure. Filling this gap requires third-party HBOMs to be generated until vendor-provided HBOMs are available.

Third-party enumerations require identifying the electronic components that comprise the critical infrastructure technology in question. This usually requires physical disassembly and photographing of the device, a heavily manual process that does not scale easily. Other solutions avoid physical disassembly by utilizing X-ray, CT, and Ultrasound imaging technology to identify components. These solutions require expensive equipment, trained staff, and may have other technical limiting factors (i.e. limited sample size, struggle with shielded integrated circuits, etc.).

PHICS offers to solve the burden of manual, time-consuming enumeration by providing open-source, user-friendly, inexpensive hardware that can reduce the burden of manual enumeration photography and identification. This is just a prototype version designed by a Computer Numerical Control (CNC) - controlled routing table modified to utilize a digital microscope. PHICS utilizes a combination of CNC via the Mostly Printed CNC project [1] with a commercial Dino-Lite digital microscope. The software is created using Python to interface the hardware and perform semi-automated enumeration.

The digital microscope has been made fully functional and software controllable. As a result of finishing the functionalities in the microscope, PHICS has produced detailed imagery from commonly difficult component enumerations and has significantly decreased the amount of time necessary for recording traditionally lengthy enumerations.

References

[1] V1Engineering, "Introduction to MPCNC." v1e.com. https://docs.v1e.com/mpcnc/intro/ (accessed Aug. 20, 2024).

[2] Dinolite, "AM8917MZTL." dinolite.us. https://www.dinolite.us/products/usb-microscopes/usb-edge-plus/am8917mztl/ (accessed Aug. 20, 2024).