Robotic Forensic Analysis Tool for Multiple Parameter Sensing

Anonymous

Robotic Forensic Analysis Tool for Multiple Parameter Sensing

ABSTRACT

This disclosure describes a robotic forensic tool that includes sensing probes for performing automated forensic analysis. The robotic tool can support multiple sensing probes that are mounted such that they can hover over the device under test (DUT) and perform measurements. Tools are mounted on the robotic cantilever which enables navigation across a device under test to provide measurements of different physical properties of the device with minimal human intervention. Measurements can provide statistical analysis to drive regions of confidence and to provide inferences regarding the devices under forensic investigation. This setup includes a probe holder that enables its attachment to a robotic arm and adjustment of the probes while it scans the device. The probe tool includes an optical sensor that guides navigation over a device under test. An augmented 3D overlay is utilized to visualize the results via a visual image feed.

KEYWORDS

- Digital Forensics
- Hardware Inspection
- Robotic Cantilever
- Statistical Inference
- Capacitance Analysis
- Magnetic Field Analysis
- Electromagnetic Interference
- Thermal Analysis

BACKGROUND

Digital forensics or forensic computing refers to the collection and examination of digital evidence that resides on electronic devices. The field initially emerged from the needs of law enforcement and has evolved to become an integral part of law enforcement investigations. Digital forensics includes hardware forensic analysis, which involves data collection of physical parameters acquired from a computing (electronic) device under test. Measured physical parameters can be utilized as clues to determine the legitimacy of a given component under investigation.

For example, when the hardware components of a given computer are analyzed as part of a digital forensic examination, properties of its components are compared to baseline properties available for the computer model. To enable accurate comparison and analysis, such measurements have to be consistent and repeatable. Digital forensic analysis involves considerable complexity and requires dexterity when performed by a human user (analyst). This adds operational costs and prolongs the time required for an investigation. Such measurement is not scalable and has variability in the results introduced by human error.

Digital forensics techniques have had limited success in developing timely and efficient techniques for hardware verification, and face challenges such as:

- Large number of investigations requiring digital forensic investigation
- Complexity of obtaining physical measurements from devices
- Insufficient automation for measurement and analysis
- Measurements commonly require multiple test benches that slows operations
- Lack of analysis tools for the comparison of test results with baseline results

DESCRIPTION

This disclosure describes a robotic forensic tool that includes sensing probes for performing forensic analysis of computing and electronic devices. The robotic tool can support multiple sensing probes, e.g., for capacitance analysis, electromagnetic evaluations, macro infra-red imaging, etc. The sensing probes are mounted such that they can hover over the device under test. The tool is attached (mounted) to a cantilever robot that enables the navigation of the tool across a device under test to provide multiple measurement of physical properties of the device, with minimal human intervention. The measurements can be statistically analyzed to drive regions of confidence and to provide inferences regarding the device under investigation.

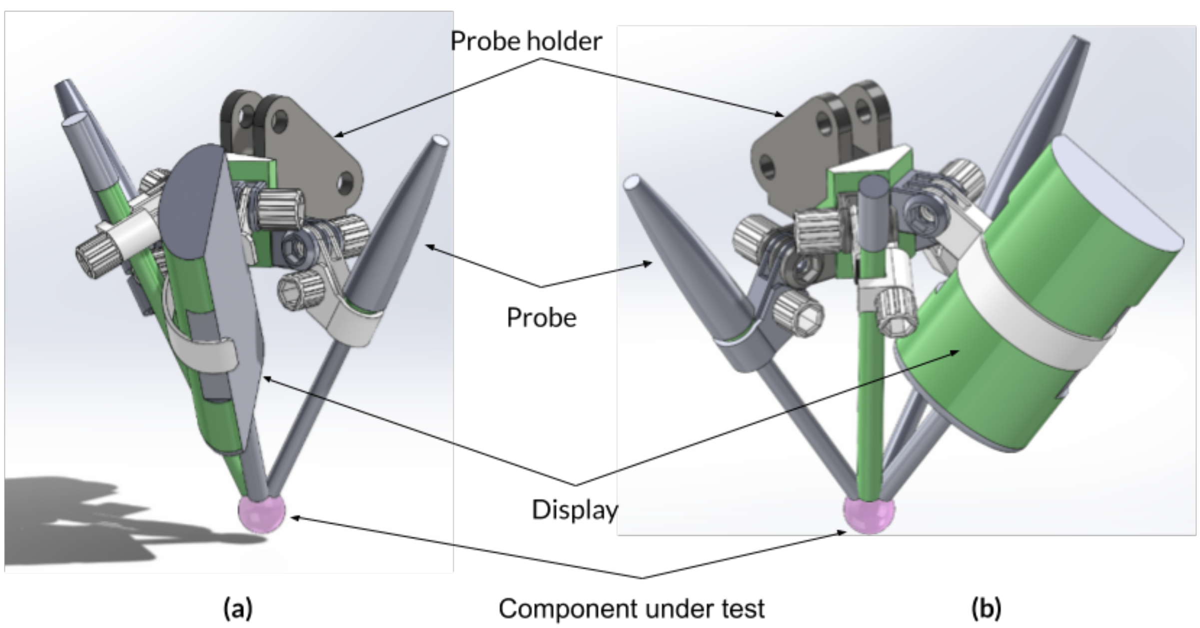

Fig. 1: Views of a forensic probe tool

Fig. 1 depicts different views of an example forensic probe tool. As depicted in Fig. 1, the forensic probe tool includes fixtures for the attachment of multiple sensing probes, e.g., Capacitance analysis (e.g., using a tungsten probe), Electromagnetic evaluations (e.g., using a near field probe), Magnetic field analysis (e.g., by utilizing a hall sensor), and macro Infra-Red imaging, referred to collectively as CEMIR.

The forensic probe tool includes a probe holder that enables its attachment to a robotic arm and adjustment of the probes while it scans the device. The probe tool includes an optical sensor that guides navigation over a device under test/investigation as well as a display that enables users to view measurement results. The probe tool enables the sensing probe(s) to hover over respective components, e.g., with a small (~0.5 mm) gap between the top of the probe and the component and generate corresponding physical measurements.

During operation, the robotic arm provides locomotion for the tool to move to and across multiple regions or components of the device under test. An image recognition system is utilized to locate different components, e.g., chips on a device circuit, and to drive the robotic arm. Multiple physical measurements can be obtained with a single pass of the tool over the device, thereby providing multiple sets of physical measurements for comparison with a baseline. An augmented 3D overlay is utilized to visualize the results via a visual image feed.

The described forensic probe tool is a single tool that provides multiple types of measurements thereby enabling automated parallel tests that are accurate and repeatable. The tool enables the generation of dedicated forensic data for various types of analysis, e.g., failure analysis, reliability analysis, etc.

CONCLUSION

A robotic forensic tool that includes sensing probes for performing automated forensic analysis of devices is described. The robotic tool can support multiple sensing probes that are mounted such that they can hover over the device under test (DUT). The tool is attached to a cantilever robot that enables navigation across a device under test to provide measurements of different physical properties of the device with minimal human intervention. The measurements can be statistically analyzed to drive regions of confidence and to provide inferences regarding the devices under investigation. The forensic probe tool includes a probe holder that enables its attachment to a robotic arm and adjustment of the probes while it scans the device. The probe tool includes an optical sensor that guides navigation over a device under test as well as a display. An augmented 3D overlay is utilized to visualize the results via a visual image feed.