SAND2019-7825D

Automated Testing for Access Control/Security Products

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BS Electrical Engineering, Winter 2022

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Commercial Off The Shelf (COTS) hardware operated with a software-based interface in Java can be integrated with existing security systems. One of the best ways to validate software is through experimental testing. To this end, the project uses automated robotic systems to operate COTS hardware during case testing.

Java Interface sends Serial Commands to Robotic System

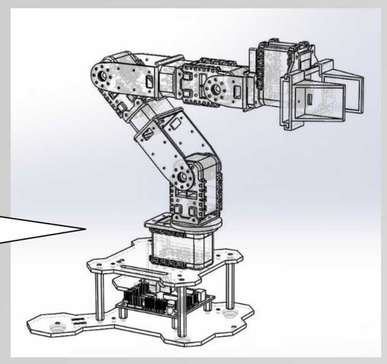
Interface records test response and initiates new test.

Card Reader sends its response to overlying interface

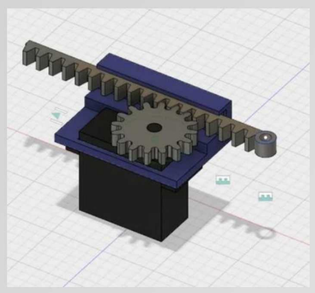
Java Interface

C++ Microcontroller

A 4-DOF servo arm uses inverse kinematics to insert PIV cards.



Robotic Arm



Linear Servo

An array of 12 linear servo actuators manipulate the number pad.

PIV Card[1]

Keypad

COTS Card Reader[2]

Test Cases

1. Valid/Invalid badges, User IDs, and PIN numbers.
2. Distress, Heartbeat, or Tamper signals.
3. Expected or unexpected user operations.

Interface to Microcontroller Serial Communication:

The microcontroller runs a C++ script and holds a pre-programmed range of arm motions and gripper actions. It responds to various prompts from the Java Interface over a serial connection by executing the corresponding action and returning a confirmation message. The serial communication takes place over a USB-UART cable, initiated by the Java program on the PC.

Testing and Moving Forward:

Mechatronics is necessary in facilitating end-to-end integrated hardware and software testing of a cyber/physical security system that utilizes a hardware edge device like the COTS Card Reader. This automated system can run hundreds of tests through day and night to find rare errors in the system that runs the Card Reader. As each interaction is logged, these records make the rare errors easier to repeat and diagnose. These qualities are invaluable to high-consequence security systems.

[1]https://piv.idmanagement.gov/img/elements.png
[2]https://www.hidglobal.com/sites/default/files/pivclass-rk40_0.png