



RET Site: Research Experience in Cybersecurity for Nevada Teachers (RECNT)



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Introduction

Students in participate in a hands-on project integrating Cybersecurity and chemistry. This allows greater retention of chemistry facts, allows students to explore career opportunities in modern day, chemical processing careers, and to generate opinions and understanding on the political and global ramifications of the vulnerabilities in the utility systems that run our society. They are introduced to networking, coding, and modern network system susceptibilities.

Essential Questions

Students are tasked with answering:

- Did a chemical reaction occur?
- Which reaction occurred?
- Was the automated process secure?
- Where in the automated process could a malicious entity cause problems in the system?



Developing an Autonomous System

Students develop their own autonomous system to grab and mix chemicals using a robotic arm.

Coding can be done in many ways in order to differentiate:

- C/Arduino
- Lewan's software through a computer or mobile device
- Controlled by hand, controller, mobile, or mouse in order to create a macro of positions.

The creation and troubleshooting promotes critical thinking and helps generate interest in engineering careers.

By knowing how autonomous systems are made, students can better understand how malicious attacks can change the code.

Navigating Linux

Students are introduced to the Linux operating system. The terminal and command line will allow students to experience a new way of looking at information and computer structure.

First, students will learn to navigate and edit the file system. (ls, cd)

Second, students will learn about network structure.

They will learn about how to find their own IP address and those of other devices.

By learning these Linux commands, students will gain an understanding on how malicious attacks can navigate an unprotected system.

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millier@pc101:~$ ifconfig
br0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.16.1.228 netmask 255.255.255.0 broadcast 172.16.1.255
    ether fe80::cc40:b1ff:f684:4d69 prefixlen 64 scopeid 0x20<link>
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

br1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 1a:f0:7e:f7:33:ca txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

br2: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 82:77:0a:1b:13:83 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

br3: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether a2:28:10:a8:73:09 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

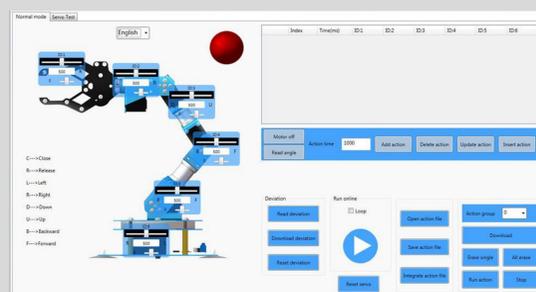
br4: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    ether 9e:1d:62:de:73:7b txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

```

Remote Access and Vulnerabilities

Students will remotely connect to another computer and transfer their files. They will also get an introduction to malware and other methods of vulnerabilities that can affect a computer and network.

This will allow students to have a conversation about future research that can be done into connecting to other devices. Hopefully, this will interest students in cybersecurity and lead into other examples of encryption and security.



Conclusions

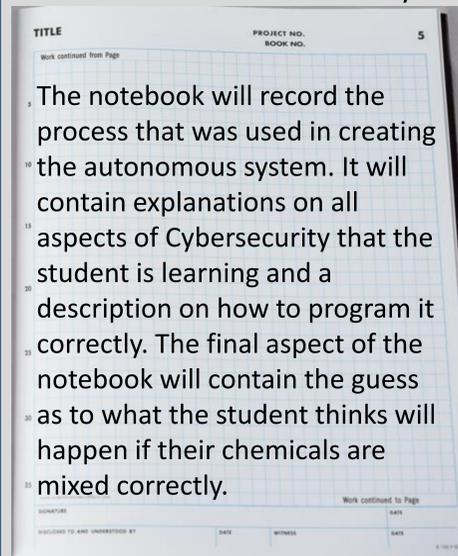
Analysis of the final solution will allow students to come to their own conclusions on the final product and the security of the automated process.

The physical properties of the final mixture and the creation of a precipitate will allow students to deduce what happened during the automated process.

The final product will be used to detect whether or not the automated process was changed from their program. Students will also be able to pinpoint the moments where the automation was insecure based on their new understanding of networking.

Evaluation

Students will be evaluated by an engineering notebook and report.



The notebook will record the process that was used in creating the autonomous system. It will contain explanations on all aspects of Cybersecurity that the student is learning and a description on how to program it correctly. The final aspect of the notebook will contain the guess as to what the student thinks will happen if their chemicals are mixed correctly.

The report will contain all of the conclusions the student has generated from the project. The analysis of the end result and student's explanation on how this affects current society must be succinctly summarized based on evidence from the project.

References

Kennedy, Sheila. "Cybersecurity Attacks Pose Big Threats." *Chemical Processing*, www.chemicalprocessing.com/articles/2018/cybersecurity-attacks-pose-big-threats/.

Lewansoul, www.lewansoul.com/product/detail-27.html.