Using LabVIEW To Do Totally Legal Things Online

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#OurGiantsAreFemale



- Dr Genevieve Lipp, Assistant Professor of the Practice in Mechanical Engineering and Electrical and Computer Engineering at Duke University
- Teaches classes including Dynamics, Robotics, Control Systems (uses LabVIEW ⁽ⁱ⁾), programming for nonprogrammers
- Recently named Director of Duke's New First Year Computing program required by all freshman engineers beginning Fall 2024 (not LabVIEW ☺)
- Every Duke engineers' first meaningful college programming course will be taught by Genevieve



By The End of This Session You Will:

- Identify basic HTTP Terminology
- Learn how to interact with the information on a web page through LabVIEW
- Learn About a FREE 3rd party tool that Accelerates Web Development
- NOT become Java or HTML Expert
- NOT Become a Hacker or Malicious Internet User (*PROMISE ME*)

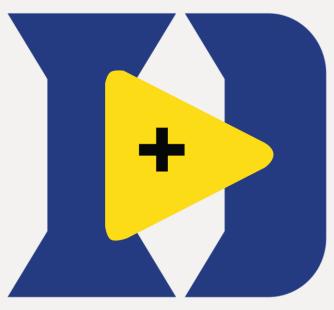
About Me



- BSE in Mechanical Engineering and Materials Science from Duke University
- Working at Duke since 2016
 - First in MEMS designing teaching lab experiments and writing LabVIEW code for test stands
 - Current: R&D Engineer in Civil and Environmental Engineering Department designing wireless embedded sensor systems
 - I'm an ME in CEE doing ECE...makes no sense
 - Work mentioned in this presentation funded by ONR N00014-23-S-B001

NEW USER GROUP PLUG

- We've started a new LabVIEW User Group in Durham, NC!
- If you live in the Durham, Raleigh, Chapel Hill, or Research Triangle Park area, come join us!!
- Next Meeting is August 21, 2024





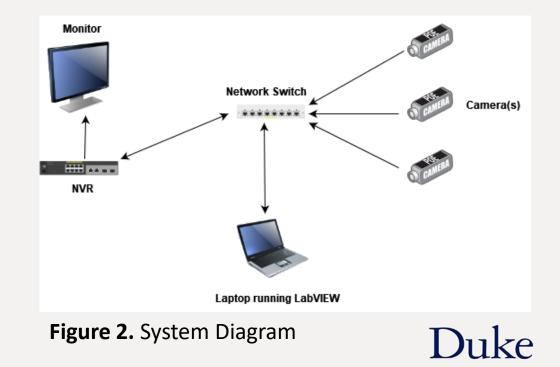
Background

- Network video recorder (NVR) standalone device that controls and stores IP camera feeds
- NVR handles recording, storage, settings
- Port for mouse, monitor to use device
- Also has a network port (as suggested by the name)
- NI DAQ collecting analog measurements with LabVIEW and NVR for storing IP camera video
- Test runs involved starting each device separately (NVR required navigating multiple menu screens)
- Improve setup by integrating NVR start/stop record functionality into LabVIEW application
 - Less cumbersome, less equipment





Figure 1. Network Video Recorder



Plan A

- Communicate via TCP/UDP
- I'll just peek at the manual...
- No documentation in user manual
- Reach out to company— any API?
 - Response:

Company: We have no API. The manufacturer does not provide for security reasons Me: Can we try asking the manufacturer? Company: We are not allowed to give their information

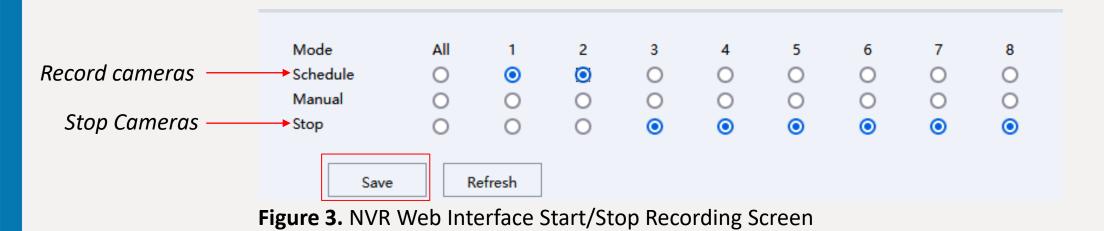


Not helpful

Me: 😕

Well, it has a web client? So...Plan B?

- There is a web client that allows you to use NVR thru web browser
- In LabVIEW, can I perform the action of changing the radio button values then trigger the action that results from pressing Save?



HTTP Terminology

- HTTP (Hypertext Transfer Protocol): application layer used in the internet
- POST: request method for a web server to accept data enclosed in the body of a message
 - Formatted like XML, potentially
 - Has a header, body
 - Often used when uploading file or submitting a form, click button, sending post request
- GET: retrieve information from the web server
 - Opening a webpage
- Must define a URL to send the request

I determine I will need to make a POST request, but what should be the message? And URL?

Source: https://en.wikipedia.org/wiki/HTTP#Request_methods



Web Pages – Under The Hood

schedule

- Right-click on a webpage (CTRL+U) → View Page Source
 - Source Code for the webpage
- Search Source Code for Web Client, Search for Relevant Terms...
 - Schedule is term used to start recording
- No hits...
- Stop not found either

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A V V Highlight <u>A</u>ll Alt Match <u>C</u>ase Match D<u>i</u>acritics <u>W</u>hole Words Phrase not found

Figure 4. Searching NVR Interface Code for 'Schedule' Keyword

</div>

Web Pages – Search Web Client

- Oh, there's some Javascript links at the end!
- Specifically, one called Video_control.js
- Super! Let's see what this yields...

624 <script type="text/javascript" src="js/setting/AlarmSetting.js" charset="utf-8"></script> 625 <script type="text/javascript" src="js/setting/VideoBlind.js" charset="utf-8"></script> 626 <script type="text/javascript" src="js/setting/VideoLoss.js" charset="utf-8"></script> 627 <script type="text/javascript" src="js/setting/AlarmEventException.js" charset="utf-8"></script> 628 <script type="text/javascript" src="js/setting/Configuration.js"></script> 629 <script type="text/javascript" src="js/setting/Encodset.js"></script> 630 <script type="text/javascript" src="js/setting/Wheelset.js"></script> 631 <script type="text/javascript" src="js/setting/Splitscreen.js"></script> 632 <script type="text/javascript" src="js/setting/Disk basicset.js"></script> 633 <script type="text/javascript" src="js/setting/Disk advancedset.js"></script> 634 <script type="text/javascript" src="js/setting/Disk smartset.js"></script> <script type="text/javascript" src="js/setting/Video control.js"></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></script></scr 636 <script type="text/javascript" src="js/setting/User account.js"></script> 637 <script type="text/javascript" src="js/setting/Automatic maintenance.js"></script> 638 <!-- <script type="text/javascript" src="js/flowplayer-3.2.13.min.js"></script> --> 639 <script type="text/javascript" src="js/setting/eventLinkageComment.js"></script> 640 <script type="text/javascript" src="js/setting/LineCross.js"></script> 641 <script type="text/javascript" src="js/setting/AreaIntrusion.js"></script> 642 <script type="text/javascript" src="js/setting/UnattendedObject.js"></script> 643 <script type="text/javascript" src="js/setting/ObjectMissing.js"></script> 644 <script type="text/javascript" src="js/setting/RegionEntrance.js"></script> 645 <script type="text/javascript" src="js/setting/RegionExiting.js"></script> 646 <script type="text/javascript" src="js/setting/FastMoving.js"></script> 647 <script type="text/javascript" src="is/setting/outputMode.js"></script>

Figure 5. Javascript code on NVR Interface

Video_control.js Yields Chaos

function Video controllanuage()

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tdkcgi";xhr2.open("POST",p,true);xhr2.onreadystatechange=SETxmlVideocontrol2;xhr2.send(m)}function SETxmlVideocontrol2(){if(xhr2.readyState==4){if(xhr2.status==200){var b=xhr2.responseXML;var a=b.getElementsByTagName("error")[0].firstChild.data;if(a==0) {alert(languageXMLStr("Translation", "K0492_Saved_Successfully"))}else{alert(languageXMLStr("Translation", "K0963_Save_Lost"))}};

Figure 6. Chaos

I Don't Know What To Do With This Information

- Should I pack it in?
- Should I become an expert on web development for the convenience of a few button clicks?
- NONE OF THE ABOVE!
- I just need an *insight* (shoutout Norm) there's a tool that will give me one

BurpSuite

- Application by PortSwigger for web application security testing
 - https://portswigger.net/burp
- Users include Amazon, NASA, Barclays
- Free community edition
 - Free edition has limited tools
- Many thanks to Sam Taggart for referral





The most widely used web application security testing software.

Find out more →

Figure 7. Helpful! But don't abuse it...

Burp Suite – Proxy Intercept History

- Allows you to open web browser and intercept the HTTP requests to (among other things) view GET and POST history and URL
- Why is this useful? You can learn what is happening under the hood when you interact with a website
 - Also, a really great way to learn what 3rd parties (like FaceBook) are accessing your data on the webpage. A little freaky, but not surprising...
- Sometimes the URL is just the URL of the website, sometimes it's some URL that you never see



Burp Suite – Intercept HTTP POST Request

	252 http://141.211.142.112 POST /tdkcgi			~	200 /65	XML
URL	253 http://141.211.142.112 POST /tdkcgi			~	200 213	XML
ONL						
	Request Pretty Raw Hex	8	⇒ \n =	Response Pretty Raw He	ex Render	
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POST Message Body	<pre>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>></pre>		<pre>><id>3 de> /record><!-- --><id>7</id></id></pre>	to check if POST was		
	⑦ (۞ ← → Search Event log (1) • All issues	٩	0 highlights	⑦ ⊕ ← → s	earch	

Figure 8. BurpSuite Interface when Pressing Save Button on NVR

Duke

Generating the POST Request From LabVIEW

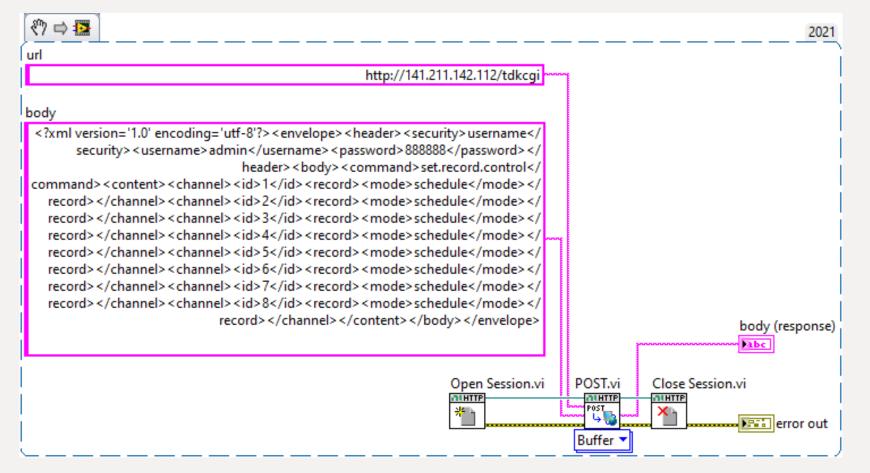
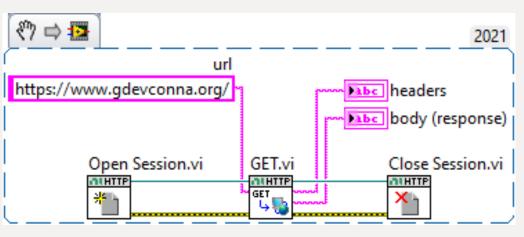


Figure 9. HTTP POST Request to Start Recording in LabVIEW

Generating a GET Request From LabVIEW



Returns page source –

HTTP/1.1 200 C						
	ul 2024 03:37:18 GN	1T				
Server: Apache						
	e-Options: nosniff					
Content-langu						
X-UA-Compati	-					
	irces/assets/lvwiki.	png?1fe0f>;rel:	=preload;as=im	nage		
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Figure 10. HTTP GET Request from Webpage

An HTTP Based API For NVR (Take That, Anonymous Manufacturer!)

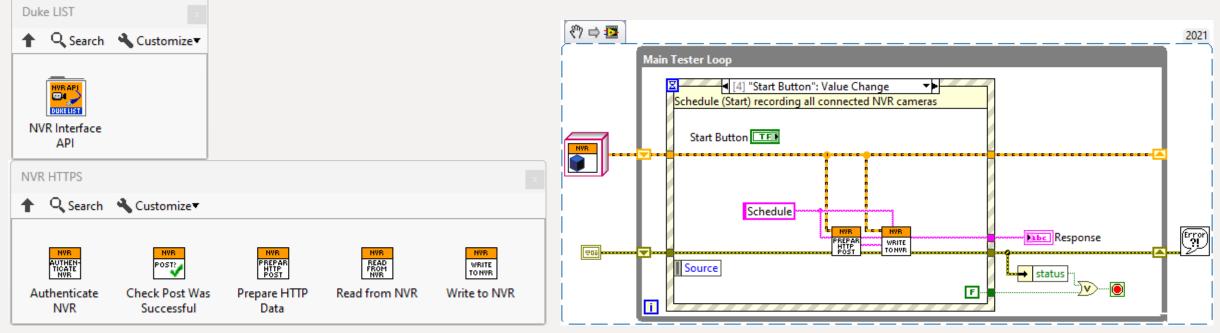


Figure 11. NVR Interface API Toolkit

Figure 12. Toolkit Tester VI



Demo #1: BurpSuite Demo

• Open Webpage, intercept with proxy, get HTTPS history



Demo #2: (Theoretical) GDevCon NA Cookout

- It is summer, which means everyone is having a cookout
- Worse, my inbox is flooded with Google forms asking me to RSVP and signup to bring food
- I can't take it anymore so I'm going to create a LabVIEW tool to see what other attendees are bringing and to automate my responses based on what is needed



HTTP In LabVIEW

- LabVIEW ships with HTTP functions (Connectivity → Protocols)
 - Don't use these
- I like the NI Advanced HTTP Client API (DNatt contributed so you know it will be readable)
 - Simple, easy to use, gets the job done
 - Intended be a replacement for the shipping API

Figure 11. VIPM Page for HTTP Client API

NI Advanced HTTP Client API

More info on the web

NI Advanced HTTP Client API v1.1.0.6 by NI Released On: Sun, 03 Mar 2024 20:48:23 +0000 Author: NI Copyright: Copyright (c) 2024, NI License: MIT Compatible LabVIEW Versions: >= 2019. Compatible OS Versions: Windows. Repository Name: VIPM Community

Description:

A1.

This API is intended to be a replacement for the HTTP Client API (Data Communication > Protocols > HTTP Client) that ships with LabVIEW. This new API includes multiple benefits over the existing LabVIEW API including:

1. Support for the PATCH verb.

2. Support for any arbitrary HTTP verb via a 'Generic Request' VI.

3. Better compatibility with newer HTTP versions.

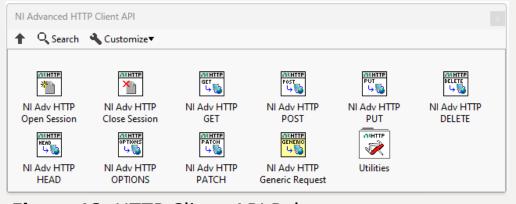


Figure 13. HTTP Client API Palette

WEB SECURITY (This Slide Included So Eric Reffett who talked about Security At GDevCon NA 2023 Doesn't Leave With His Head In His Hands)

- With enough time and energy, anything can be hacked
- Remove low hanging fruit
- Don't store passwords in VIs
- Messages could contain password information, remove passwords (separate lock from key)
- In my application, kept message template in database, with password removed, encrypted is good



Use Your Newfound Web Skills Wisely...

Hacking!

- Malicious and reckless behavior!
- Automating some boring stuff or adding some dynamic update capabilities from web or LAN sources to your LabVIEW application!

BAD! BAD!

PRETTY GOOD!



Want to Learning More? Check Out These!

- Derrick's "Intro to NI Web HTTP & GET Dynamic Content"
 - https://www.youtube.com/watch?v=iji_69tzcNM
- LabVIEW NTS "LabVIEW Code Check Internet Access (HTTP Method)"
 - <u>https://www.youtube.com/watch?v=edhLgSWN3og</u>
- NI Advanced HTTP API
 - <u>https://www.vipm.io/package/ni_lib_advanced_http_client_api/</u>

MANY THANKS! Questions?

If the NSA asks, this presentation never happened

