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Cyber Security Initiative for Nevada Teachers (CSINT)

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Implementing Cyber Security & Communications Into the Classroom

Introduction & Justification

Students will be introduced to a variety of cybersecurity, communications and computer networking concepts that will enrich and deepen their levels of understanding. Among the concepts that students will be introduced to are robotics, cryptography, binary, MetaData, password access and protection, drones (manipulating and programming) along with basic encryption and decryption techniques.

The courses that will integrate these concepts are Principles of Business & Marketing, Entrepreneurship and Web Design & Development. The students in Web Design & Development, due to curriculum and standards alignment, will experience more of a range of cybersecurity concepts. For the other courses, cybersecurity will be introduced in a way that creates awareness for students and shows students how to protect their information to the best of their ability. With technology becoming more involved in our daily lives, we must identify best practices for keeping information secure and knowing that there are threats and vulnerabilities that can negatively impact our ability to communicate and network.

Objectives & Standards

Objectives:

Students will be able to:

- Understand the various ways to interact and communicate with drones.
- Develop an understanding on how to create a program using JavaScript (Drones & Web Design)
- Learn the basic function of cryptography and complete activities based on the Pig Pen and Caesar ciphers
- Use cryptography to encrypt and decrypt messages and then translate plaintext using the Ascii table

Standards: Web Design & Development

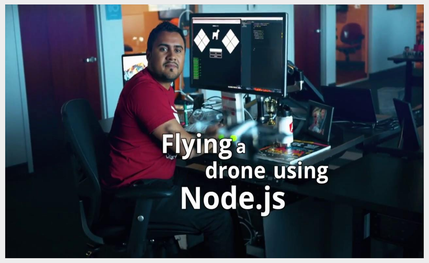
Content Standard 2.0 – Understand Ethical Use of Information – Performance Standard 2.2 - Understand Security Issues in Relation to Web

- 2.2.1 – Explain invasion of privacy in the use of technology
- 2.2.2 – Model acceptable security practices
- 2.2.4 - Differentiate between secure and unsecure web protocols

CCSS ELA-Literacy.SL 9-10.1

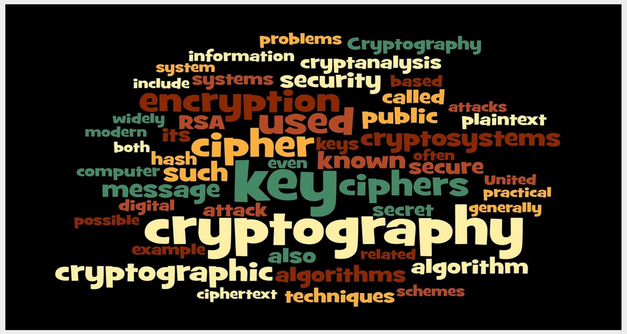
- Cite strong/thorough textual evidence to support analysis of what the text says explicitly and inferences drawn from the text, including determining where the text leaves matters uncertain

Drones



Students will be introduced to a drone and will learn ways to interact with the drone. From a web design perspective, students should have an understanding of the JavaScript programming language, which can be used to program a drone to carry out a sequence of functions. From a communications perspective, students will also learn about vulnerabilities with drones and how to integrate security measures to protect a drone from an unwanted attack.

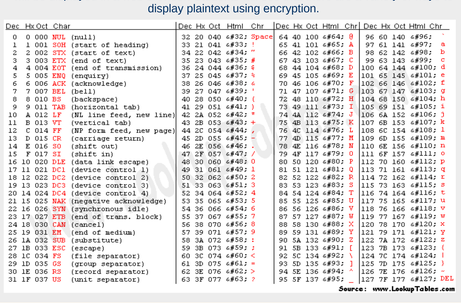
Cryptography



As an extension of cryptography activities that were carried out during the 2017-2018 school year, students will get both a refresher in basic cryptography as well as learn new strategies and techniques on how to integrate encryption and decryption into their computer communications. Students will learn basic ciphers, such as the Caesar, Pig Pen and Atbash. Students will also use hashing to authenticate digital artifacts, which will require knowledge of various hashing algorithms. Ideally, students will be able to develop their own encryption algorithms and test them with classmates. Students will learn the importance of encrypting communications as a means to ensure that their information is kept private and secure.

Engage

To engage students in cybersecurity concepts, cryptography worksheets will be used in the classroom as a critical thinking exercise. Students will be required to decrypt a specific message, but will need to collaborate with classmates to identify all of the keys. Once decrypted, the message will be converted to binary, hexadecimal and HTML before. At that time, the message will be included on an HTML5 document that will be displayed in a web browser. Students will see that there are a variety of ways to display plaintext using encryption.



Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040		Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH (start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN (synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB (end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN (cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM (end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB (substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC (escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS (file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174			|
29	1D	035	GS (group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS (record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US (unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

After being introduced to binary and hexademial calculations, students will further their knowledge by converting binary codes to numerical values. Once those values have been calculated, students will then be able to convert numerical values to hexadecimal formats. Tutorial videos will be encouraged as well as collaborative opportunities that allow students to work together to solve problems using creative and effective methods.

In the examples provided below, you will notice that each of the images are representing the same exact statement which helps us accomplish our goal of displaying text and numbers in a variety of ways.

```
Welcome of the Fall 2018 semester!
```

```
57 65 6c 63 6f 6d 65 20 6f 66 20 74 68 65 20 46 61 6c 6c 20 32 30 31
38 20 73 65 6d 65 73 74 65 72 21
```

```
<p>Welcome to the Fall 2018 semester!</p>
```

```
&#87;&#101;&#108;&#99;&#111;&#109;&#101;&#32;
&#116;&#111;&#32;&#116;&#104;&#101;&#32;
&#70;*#97;&#108;&#108;&#32;
&#50;&#48;&#49;&#56;&#32;
&#115;&#101;&#109;&#101;&#115;&#116;&#101;&#114;&#33;
```

Elaborate

Binary Number	1	0	1	1	0	1	Decimal Number
Power of base	2^5	2^4	2^3	2^2	2^1	2^0	
Decimal equivalent	32	16	8	4	2	1	
Magnitude of each term	32	0	8	4	0	1	45

To elaborate on this topic, students could engage in interdisciplinary coursework, mathematics in particular. How does a computer read information? Students, in small groups, will put together a presentation on what binary is, why it is important and how it is calculated. As students teach their math classes, they will distribute worksheets, featuring binary math problems, to students in those classes. Essentially, students will be teaching their math class. We all use technology to some extent. However, how many of us actually understand how technology works? Introducing many students to binary and relating concepts (such as Hexadecimal) can create a connection on the interaction between user and computer interface.

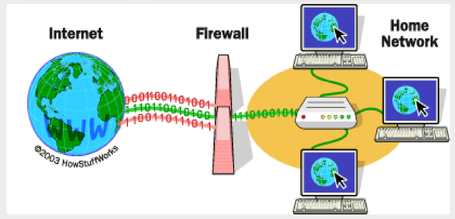
Explain

Why is it important to program a drone? Why is it important to learn JavaScript? What are the benefits to knowing commands in a terminal? How can vulnerabilities be detected on a network? What measures can be taken to remedy potential vulnerabilities? Once students have experienced different ways in which to interact with a drone, they will become more aware of the networking side. Among the concepts that will be introduced at this time are firewalls, IP tables, Intrusion-Detection Systems (IDS), Wireshark and port scanning.

```
:~$ sudo iptables -L -v
Chain INPUT (policy ACCEPT 9380K packets, 11G bytes)
 pkts bytes target     prot opt in     out     source
    destination

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target     prot opt in     out     source
    destination

Chain OUTPUT (policy ACCEPT 5821K packets, 17G bytes)
 pkts bytes target     prot opt in     out     source
    destination
```



Evaluate