High School Automous Vehicle Challenge: Software Installation

> Using and Applying Microcontrollers for the Rest of Us!

Marc E Herniter

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### I. Installing MathWorks R2017b Software

These instructions are for installing R2017b from The MathWorks. This portion of the installation can take several hours. You will need a reliable network connection, your MathWorks account name and password, and several cups of coffee. Open your web browser and go to <u>WWW.mathworks.com</u>:



You will see the window below:

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Scroll down until you see the pane for R2017b:



Click on the button that says **Download now**:



## 📣 MathWorks®

Downloads		
Download R2017b Installer		Learn MATLAB Now
1. Choose Installer	2. Download product files	Learn core MATLAB functionality with this free, interactive, self-
macOS (64-bit)	Run the installer and log in as herniter@rose-hulman.edu.	» Get Started
Windows (64-bit)	Need to install multiple platforms? Run any R2017b installer and select the Download Only option.	
Linux (64-bit)		

The library and manuals we have developed are for the Windows version so click on the **Windows (64-bit)** button:

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macOS (64-bit)	Run the installer and log in as hern Select this button.	iter@rose-hulman.edu.	»	Get Started			
Windows (64-bit)	Run any R2017b installer and select the	Download Only option.					
Linux (64-bit)							

After selecting the button, you will be asked to save the file:

Opening matlab_R2017b_win64.exe		×
You have chosen to open:		
matlab_R2017b_win64.exe		
which is: Binary File (113 MB) from: http://esd.mathworks.com		
Would you like to save this file?		
	Save File	Cancel

Note the name of the file and click the **Save** button. The file most will likely be saved to your **Downloads** directory. My **Downloads** directory is shown below. Yours may be different:

### MATLAB R2017b Software Installation



Run the file named matlab\_R2017b\_win64.exe. This is a file archive. A bunch of stuff will self-extract:



When the extraction is complete, the MathWorks R2017b installer will run automatically:



Click the Yes button to start the installation:



Select the option above and click the Next button:

<u>6</u>

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📣 Log in				- 🗆 ×
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Email address:	1			MATLAB <sup>*</sup>
Password:				<b>SIMULINK</b>
	Forgot your password?			R2017b
< Back	Next >	Cancel	Help	📣 MathWorks

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MATLAB R2017b Software Installation

You will need to login to your MathWorks account. This is the same account and password that you used to obtain your license. Fill in your account and password and click the **Next** button:

1	License Se	ense Selection							×
Se	lect a licens	e or enter an A	ctivation Key						
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	40608364	2018 High Scho	ol Autonomous Vehicle C	hallenge Rose	Sponsored -	Total Headcount			
Select this year's license.									
0	Enter an Activation Key for a license not listed:								
	You may have received the Activation Key from the Administrator of the license.								
	< Back	Next >			Cancel	Help	🚽 🅠 Mat	hWork	S°

Select a license and then click the **Next** button. Your license may be named differently than the license shown above:



We will use the default directory, so click the Next button:

8				
📣 I	Product Selection			- 🗆 ×
Sele	ct products to install			
	Product	Notes		MATLAB
	MATLAB 9.3	Download Required	^	<b>SIMULINK</b>
	Simulink 9.0	Download Required		R2017b
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	DSP System Toolbox 9.5	Download Required		<b>^</b>
	Embedded Coder 6.13	Download Required		
	Filter Design HDL Coder 3.1.2	Download Required		
	Fixed-Point Designer 6.0	Download Required		
	Global Optimization Toolbox 3.4.3	Download Required		
	HDL Coder 3.11	Download Required		
	Image Processing Toolbox 10.1	Download Required		· · · · · ·
	MATLAB Coder 3.4	Download Required		
	MATLAB Report Generator 5.3	Download Required		
	Neural Network Toolbox 11.0	Download Required		
	Optimization Toolbox 8.0	Download Required		
	Robotics System Toolbox 1.5	Download Required		
	Signal Processing Toolbox 7.5	Download Required		
	Simscape 4.3	Download Required		
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< Back	Next >		Cancel	Help	📣 MathWorks•

Select the options above and click the **Next** button:



We are ready. Click the Install button. The installation will begin!

📣 0% Complete	- 🗆 🗙
Downloading MATLAB 9.3 (10 of 839 MB)	
Download in progress	
0%	
	Pause
	Cancel MathWorks

Get a cup of coffee. Get another. Get a third cup. This will take a while. Maybe a couple of hours. You do not need to watch it download. However, you should check on it occasionally.

🚸 6% Complete	- 🗆 ×	🚸 30% Complete	- 🗆 ×	🚸 93% Complete	- 🗆 ×
Downloading Simulink 9.0 (30 of 854 M8)		Downloading Simulink Design Optimization 3.3 (9 of 88 M8)		Finished downloading (4,477 of 4,477 M8)	
Download in progress		Download in progress		Installing Simulink Check 4.0	
	1.6%	10%		92%	
	Pause		Pause		Pause
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When the download/installation is complete, you will see the following screen:

## 10 ✓ Product Configuration Notes Your installation may require additional configuration steps. 1. The following products require a supported compiler: Simulink Coder 8.13 MATLAB Coder 3.4 ✓ MathWorks

### Click the **Next** button:

📣 Installation Complete	- 🗆 ×
Installation is complete.	
Activate MATLAB	MATLAB <sup>*</sup>
Note: You will not be able to use MATLAB until you activate the software.	SIMULINK* R2017b
See the <u>Help</u> to learn more about activation.	
< Back Next >	Cancel AthWorks

You will need to activate MATLAB. Assuming that your internet connection is active, this should go smoothly. Click the **Next** button:



Click the **Next** button:



### Click the **Next** button:

Activation Complete	- 🗆 X
Activation is complete.	
	MATLAB
	SIMULINK
	R2017b
	A
	Finish - MathWorks

We are done! With this part... Click the **Finish** button.

### II. Installing the KL25Z Support Package

Next, we need to install the hardware packages for the KL25Z, the microcontroller we use on our cars. We will do this in MATLAB. Run MATLAB R2017b:

<u>12</u>

### MATLAB R2017b Software Installation



### Select Add-Ons and then Get Hardware Support Packages:



The Add-On Explorer will open:



### Enter NXP in the search bar:



Click on **Simulink Coder Support Package for NXP FRDM-KL25Z Board** as shown above. The package will be selected as shown below:

			- 0
			Manage Add-Ons
*	Search for add-ons		Q
	Simulink Coder Support Package for NXP FRDM-KL25Z Board version 17.2.0.0 by MathWorks Embedded Coder Team Generate and deploy code for NXP FRDM-KL25Z.		★★★★★★★★★★★★★★★★★★★★★★★★ 44 Downloads Updated 14 Jun 2017
Dverview	A Hardware Support	Learn More	Install 🔻
mulink <sup>®</sup> Coder™ Su RDM-KL25Z board.	ipport Package for NXP™ FRDM-KL25Z Board enables you to create and run Simulink <sup>®</sup> models on an NXP The support package includes a library of Simulink blocks for configuring and accessing NXP FRDM-KL25Z	Requires	
eripherals and comr	nunication interfaces.	Simulink	
his support package	is functional for R2014a and beyond.	MATLAB Coder	
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Comments and R	`atings (4)	MATLAB Release MATLAB 9.1 (R2016b)	
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Comments and F Rate this submission Comment on this sut Manuel Ricardo Alfonso Sánchez 13 Jun 2017	Ratings (4)	MATLAB 9.1 (R2016b) Togs Controls systems d freescale freescale (mage processing ( rxpcup) projectbass	Add Tags igital signal pr) cup txp ed lear

### Click the **Install** button:

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THIS AGREEMENT REPR	ESENTS THE ENTIRE AGRE	EMENT RETWEEN YOU	
(THE "LICENSEE") AN	D THE MATHWORKS, INC.	("MATHWORKS")	
CONCERNING THE SOFT	WARE AND DOCUMENTATION	MADE AVAILABLE FOR	
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DV CUECUTIC IT ACCU	DTIL OD ACCECCTUC TUCCE	WATERTALS WOU	
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### Accept the agreement:

clicking Next, you will be installing the software below v urce software that may be under the terms of General P	/hich may contain open ublic License (GPL).
Simulink Coder Support Package for NXP FRDM-KL2	5Z Board version 17.2.0
Third-Party Software:	
GNU Tools for ARM Embedded Processors	License
Mbed Library	License
CMSIS	License

Click the **Next** button. Software will download and install. This might take a while:

14



If something unexpected occurs, just try again. At some point, the screen below will appear:



### Click the Yes button:

	×
Download and Installation Progress	
🤣 Downloading Support Packages 100%	
🤣 Downloading Third-Party Packages 100%	
🤣 Installing Support Packages 100%	
C Installing Third-Party Packages (may take a few minutes)	
Configuring your installation	
	Cancel

When the installation is complete, you will see the window below:



Click the **Setup Now** button:



### Click the Next button:

P Cup Companion app from the Add-On Explorer provides an hanced user experience of the NXP FRDM-KL25Z support package. If additional early installed. Click Next, Otherwise, Click the Open Add-On Explorer to install the app from the Add-On Explorer.	What to Consider What to Consider When issuching the AdS-On Explorer, ensure that the computer is contexted to the intermet. Is optimate the installation of the AdS-On Explorer, and the AdS-On Explorer, after installation and the ads on Explorer, after installation. 1. (Lick Next to complete further steps in the ads). 2. (Launch the age form Mathia additional additio	Click this button.
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The Open Add-On Explorer. The window will open showing the NXP Cup Companion:



### Click the Add button



### Accept the license agreement:

Add-On Explorer			- D X	
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With this App you can + Create new models + Automatically config + Open a library of all + Open Examples for	n: pre-configured for the NXP FRUM-KL2SZ hardware. gure an existing model for use with the NXP FRUM-KL2S2 locard. It he blocks created specifically for the NXP Cup Competition. the NXP FRUM-KL2SZ Support Package and NXP Cup Competition.		Requires Simulat Embedded Coder Support Package for Freescale FRDA-K1252 boad http://www.mathworks.com/matlaborthal/fileacc http://www.mathworks.com/matlaborthal/fileacc	Stuff is happening.
Comments and R Rate this submission	Ratings (2)		MATLAB Release MATLAS 1: 1 (FC20100)	
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Abhishet GS 3 Oct 2016	****			
Bhaskar Reddy	*****			

When done, the screen will appear as shown:

When done, the window should appear as shown:

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NXP Cup Computer version 16.2.5 (1.9 MB) by Math This App simplifies and enhance the main sector of the sector of	Works Student Competitions Team Works Student Competitions Team es a user's experience with the NXP FRDM-KL25Z Board Support Pack	age.	A the second secon	
With this App you can: + Create new models pre-configured for the NX + Automatically configure an existing model for test + Open a library of all the blocks created specifical + Open Examples for the NXP FRDM-KL25Z Supp	Package is installed. Installed. Ity for the NXP Cup Competition. Package and NXP Cup Competition.		Requires Simulink Embedded Coder Support Package for Freescale FROM-KL252 board http://www.mathworks.com/matlabcentral/fileexc hange/46880	Click here to close.
Comments and Ratings (2)			MATLAB Release	
Rate this submission $\star\star\star\star\star\star$ (Rating not re-	equired)		MATLAB 9.1 (R2016b)	
Comment on this submission		li di	Tags         Add Tags           freescalecup         mxpcup	
Abhishek GS Abhishek GS 3 Oct 2016				
Bhaskar Reddy 🔶 🔶 📩 📩 📩				•

Close the Add-On Explorer as shown above. The window below should still be open.



Click the Next button:



Click the **Finish** button. We are done with this part. You should still have the window below open:

Add-On Explorer				
			Manage Add	dd-Ons
	Search	h for add-ons		
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Overview	Hardware Support			
Simulink <sup>®</sup> Coder™ Sup	pport Package for NXP™ FRDM-KL25Z Board enables you to create and run Simulink <sup>®</sup> mode	ls on an NXP	Requires	
FRDM-KL25Z board. T	The support package includes a library of Simulink blocks for configuring and accessing NXP I	FRDM-KL25Z	Simulink Coder	
peripherals and comm	unication interfaces.		Simulink	Click here
This support package	is functional for R2014a and beyond.		MATLAB Coder	
			MATLAB Release	Close.
Comments and Pe	rings (A)		MATLAB 9.1 (R2016b)	
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Rate this submission	<b>***</b>			
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			Image processing nxp	
Manuel Ricardo Alfonso Sánchez	t does not works in Linux Mint!		(nxpcup) (projectbased lear)	
13 JUN 2017				

Close this window as shown above. We are done with this part.

### III. Installing the Rose-Hulman HSAVC Library

The libraries are available on my website. To download the libraries, click <u>here</u>. After you click the link, you should be prompted to save the file:

20		
Opening HSAVC_Lib	prary_Installation_for_R2017b.zip	×
You have chosen to	open:	
📙 HSAVC_Libra	ry_Installation_for_R2017b.zip	
which is: Com	pressed (zipped) Folder (43.7 MB)	
from: http://w	iki.ece.rose-hulman.edu	
What should Firefo	x do with this file?	
O Open with	Windows Explorer (default)	$\sim$
Save File		
Do this <u>a</u> uto	matically for files like this from now on.	
	ОК	Cancel

Save the file. It should be saved to your Downloads directory. If not, find it. Open the **Windows File Explorer** and find the file. Mine is in my **Downloads** directory:

🛼   ෫   Downloads						
File Home Share View						
Image: Pin to Quick access     Copy Paste     Image: Copy Paste       Pin to Quick Copy     Paste     Paste shortco	ut Move Copy to - Delete Rename	New item ▼ ↑ New folder	✓     ↓     Open       Properties     ∠     Edit       ✓     ↓     Histor	<ul> <li>Select all</li> <li>Select no</li> <li>Select sel</li> </ul>	ne ection	
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← → × ↑ 🖡 > This PC > Down	loads >					
> 📌 Quick access	Name HSAVC_Library_Installation_fq matlab 82017b win64 eve	r R2017b.zip	Dati 11/ <sup>-</sup> 11/2	e modified 0/2017 12:07	Type Compressed (zipp	Size 44,721 KB 116.047 KB
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> 📜 Pictures						

The file is a zip file archive. You should have a tool to extract the archive. Right-click on file **HSAVC\_Library\_Installation\_for\_R2017b.zip** and select **Extract All**:

### MATLAB R2017b Software Installation



<u>21</u>

Copy the name of the folder (type **ctrl-c**) that will be created and click the **Extract** button. A folder should open showing the extracted files. Your folder should look as shown below:

22				M	<u>ATLAB R2</u>	<u>2017b Softwa</u>	<u>are Installatio</u>
📙   🚽   HSAVC_Lib	rary_Installation_for_R2017	/b					
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		Name	^	Da	te modified	Туре	Size
🖈 Quick access		Lesson 12 Files		11	/10/2017 12:16	File folder	
🐉 Dropbox		Pref Directory		11	/10/2017 12:16	File folder	
OpeDrive De	vronal	🔚 High School Autonomous Ve	hicle Competition.mltbx	11	/10/2017 12:16	MATLAB Toolbox	44,717 KB
a OneDrive - Personal		Setup_AVC_Software.m			/10/2017 12:16	MATLAB Code	2 KB
🔙 This PC							
늘 Desktop							





Click on the search button as shown below:

MATLAB R2017b - sponsored use		- 0 ×
HOME PLOTS APPS SHORTCUTS		Search Documentation D Marc
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FILE VARSEDLE	CODE BURNAM EXPENSION MEDICALES	
👒 🐖 🔄 📣 Detect_KL25Z_Board 📣 Display Camera Data 📧 Open Manual 🖉 Device	Manager Sa Co To AVC Work Directory	
◆中田図ピー・C・Users + herniter + OneDrive + Rose Projects +		
Current Folder (9)	Command Window	Click here.
Advanced HSAVC Competition     Autonomous Vehicles     Electronics CI Exam	Sponsored License ++ for use in support of a program or activity aponsored by MathMorks. Not for government, commercial or other non-sponsored organizational use.	

The directory name should be highlighted.

HOME	PLOTS	APPS	SHORTC	JTS							
New New Script Live Scrip	New Open	G Find Files	Import Save Data Workspace	New Variable	Analyze Code	Simulink	Layout	<ul> <li>Preferences</li> <li>Set Path</li> </ul>	Add-Ons	? Help	Community
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Name ·	USANG C.				highlig	hted		n aur	wart of		area or act

Type **ctrl-v** to paste the directory name you copied a few steps ago:



Press the Enter key. MATLAB should change to the directory containing the files we just extracted:

HOME	PLOTS	APPS	SHORTCI	UTS							
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We are almost done. At the MATLAB Command prompt, type Setup\_AVC\_Software:

📣 MATLAB R2017b - sponsored use								
HOME PLOTS APPS	SHORTCUTS							
Image: New Script Live Script         New Script Live Script Live Script         New Script Live Script L	Import Save Data Workspace	Analyze Code	Simulink Lay	O Preferences out Set Path	Add-Ons	? Help	Community	
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Name     Lesson 12 Files     Pref Directory     High School Autonomous Vehicle Comp     Setup_AVC_Software.m	etition.mltbx	Sponsored Li Not for gove fx >> Setup_AVC_Sof	cense fo ernment, com	or use in supp umercial or of	port of ther nor	a pro	ogram or activity spon nsored organizational ype command ere.	sored by MathWorks. use.

Press the Enter key. A message box will open.



Do not press the **OK** button. The box will close automatically. After a few moments, the dialog box below will open:

A HSAVC Shortcut Setup - 🗆 🗙	
Installation of AVC Toolbox complete.	
Setting up paths, shortcuts, and working directory. (This dialog box will close automatically.)	Do not press.
ОК	

After about 5 seconds, the dialog box below will open:

承 HS	AVC Setup Complete -		Х
i	Setup Complete! MATLAB will now exit after you click the Please restart MATLAB.	OK bu	tton.
	ОК		

Click the **OK** button. MATLAB will close. You will need to restart MATLAB manually. When you open MATLAB, it should appear as shown:



### IV. Updating the Device Driver

As one last step, we need to check the windows device driver. You will need to connect your car (the KL25Z microcontroller actually) to the USB port on your computer. Make sure that you use the SDA port on the KL25Z. Connect your Windows computer to the car as shown:

25



In the MATLAB window, click the Windows Device Manager shortcut:

MATLAB R2017b - sponsored use							
HOME PLOTS APPS	S SHORTCUTS						
New New New Open Compare	Import Save Clear Workspace	Analyze Code	Simulink Layou	<ul> <li>Ø Preferences</li> <li>t Path</li> </ul>	Add-Ons	? Help	Community Request Support Learn MATLAB
FILE	VARIABLE	CODE	SIMULINK	ENVIRONMENT			RESOURCES
🕤 🔄 📑 📣 Detect_KL25Z_Board 📣 Dis	play Camera Data 🗾 NXP Cup Companion 🛛 🖪	Open Manual 🔊 Device Ma	anager 🚵 Go To A	VC Work Directory			
The second seco	herniter > Documents > MATLAB > AVC	Work Directory 🕨					
Current Folder	•	Command Window					
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🗉 📒 Lesson 12 Files		*** Welcome to t	he High Scho	Click he	re.		<pre>mpetition!***</pre>
		Sponsored Li Not for gove	cense for ernment, comm	ercial or ot	ner non	-spo	ogram or activity sponsored by MathWork hsored organizational use.

The Windows Device Manager will open:

### MATLAB R2017b Software Installation

🛔 Device Manager	-	Х
File Action View Help		
✓		 
> 🛍 Audio inputs and outputs		
> 🔪 Batteries		
> 🚯 Bluetooth		
> 💻 Computer		
> 🔜 Disk drives		
> 🖙 Display adapters		
> 📓 Firmware		
> 🗛 Human Interface Devices		
> 🐙 Jungo		
> Keyboards		
> 🔋 Mice and other pointing devices		
> 🛄 Monitors		
> 🚍 Network adapters		
> 💂 Portable Devices		
> 🗰 Ports (COM & LPT)		
> 🖻 Print queues		
>  Processors		
> 📲 Security devices		
> 🔚 Sensors		
> Software devices		
> 💐 Sound, video and game controllers		
> 🍇 Storage controllers		
> 🚛 System devices		
> 🌵 Universal Serial Bus controllers		

The KL25Z will be listed as a port. You may need to expand the ports menu to see it. The screen below shows how it should look:



For a new installation, yours may not look like this and will need to be updated. To update the driver, right-click on the **Open SDA – CDC Serial Port** text and select **Update Driver Software**:



### The window below will open:



Select Browse my computer for driver software:



The driver is on the KL25Z board, which is listed as a drive on your computer. Click the **Browse** button:



Select FRDM-KL25Z and click the **OK** button:



Click the Next button:



It did not work on mine because I already have the correct driver installed. If yours needs to be installed, make sure that you install it. When the driver is up to date, the device driver should show that the Open SDA port is working correctly as shown below:



Close the Windows Device Manager.

### V. Verifying that the Hardware Works

We are now ready to test the connection between the KL25Z (your car) and your Windows computer as shown below:

# 30 MATLAB R2017b Software Installation

In the MATLAB window, click the Detect\_KL25Z\_Board shortcut:

### 📣 MATLAB R2017b - sponsored use HOME IORTCUTS Analyze Code Community New Variable ?) -21 记 🛄 🔓 Find Files 2 0 () Preferences 🕞 Open Variable 👻 Run and Time Request Support Save Import Save Data Workspace + 22 Clear Commands + Simulink Add-Ons Open Compare Layout Set Path Help New New Script Live Script Learn MATLAB 🕤 🔄 🔚 📣 Detect\_KL25Z\_Board 📣 Display Camera Data 📕 NXP Cup Companion 🔝 Open Manual 🔊 Device Manager 🊵 Go To AVC Work Directory ◆ ◆ 〒 記 🗃 📒 ◆ \\MyDocs\MyD ・ herniter ◆ Documents ◆ MATLAB ◆ AVC Work Directory ◆ Current Folder Command Wir Name · E Lesson 12 Files Click here. \*\*\* Welcome to the High School Autonomous Vehicle Competition!\*\*\* Sponsored License -- for use in support of a program or activity sponsored by MathWorks Not for government, commercial or other non-sponsored organizational use.

If everything is working, you should see a message similar to the one below:

HOME PLOTS APPS	SHORTCUTS
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irrent Folder	Command Window
Name - Lesson 12 Files	<pre>*** Welcome to the High School Autonomous Vehicle Competition!*** Sponsored License for use in support of a program or activity sponsored by MathWorks. Not for government, commercial or other non-sponsored organizational use. KL25Z board detected on COMI</pre>

We are done. Whew...