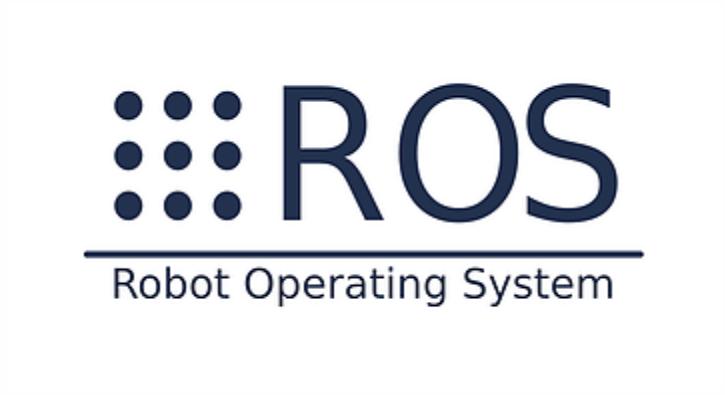


Installation of WSL, Microsoft Visual C__ 2019 Community, chocolatey, git, ROS noetic, Visual Code (vscode) and C++/ROS plugins, github bash for windows, and Windows Terminal customized for ROS on windows. Microsoft was responsible for the software port.

Based on ROS on Windows installation from: http://wiki.ros.org/Installation/Windows

1. Windows 10 Home – Test Version

This is the version the below installation worked. Version 21H1 allows WSL 2.

```
Edition      Windows 10 Home
Version      21H1
Installed on 9/27/2020
OS build     19043.1645
Experience   Windows Feature Experience Pack 120.2212.4170.0
```

2. Install Windows Subsystem for Linux (WSL) subsystem

Windows Subsystem for Linux (WSL) is an installation requirement for Gazebo (at least fpimd tp bein the past). Installation instructions found here:

https://docs.microsoft.com/en-us/windows/wsl/install

PowerShell open as administrator.

```
wsl --install
```

3. Windows Operating System requirements

- ROS for Windows requires 64-bit Windows 10 Desktop or Windows 10 IoT Enterprise.
- Please ensure that you have Powershell installed and in the system path.
- Exclude `c:\opt` (and later your workspace folder) from real-time virus Scanners, as they can interfere with install and development.

4. Reserve space for the installation

- `c:\opt` is the required install location. Relocation is not currently enabled.
- Please ensure you have 10 GB of free space on the C:\ drive for the installation and development.

5. Install Visual Studio 2019

Building a ROS project for Windows requires Visual Studio and the Microsoft SDKs for Windows.

- Download Visual Studio 2019
  - Vcpkg is used for managing dependent libraries. It requires that the English language pack be installed.
  - Include "Desktop development with C++" workload.
  - If you already have Visual Studio 2019 installed, you can Modify Installation

6. Install Windows Package Manager

Chocolatey is a package manager for Windows. It is used to make it easy to install tools and libraries needed for building and running ROS projects. The following instructions redirect the chocolatey install location into the c:\opt, so that you can clean or move a ROS environment from that one location.

1. In the Start Menu, find the "x64 Native Tools Command Prompt for VS 2019" item.
2. Right Click, select More then "Run as Administrator"
3. Copy the following command line:

```
@"%SystemRoot%\System32\WindowsPowerShell\v1.0\powershell.exe" -NoProfile -InputFormat None -
ExecutionPolicy Bypass -Command "iex ((New-Object
System.Net.WebClient).DownloadString('https://chocolatey.org/install.ps1'))" && SET
"PATH=%PATH%;%ALLUSERSPROFILE%\chocolatey\bin"
```

   - Paste it into the command window.
   - Approve any prompts
   - Once it has completed, close the command prompt to complete the install.

4. Install Git:
   - Reopen the Visual Studio Command Window as described above.

- Please install Git using the command here, even if you have it installed as an application:
- `choco upgrade git -y`
- Close and Reopen the Visual Studio Command Window as described above.
- Ensure Git is now available in the Visual Studio command window:
- `git --version`

7. ROS Noetic Installation

To set up ROS for Windows follow these recommended steps:

ROS Last Known Good (LKG) Build Installation

To get things started, install the recommended `desktop_full` metapackage. A Metapackage is a collection of other packages. The Desktop-Full metapackage refers to a number of other packages needed to build, run, debug and visualize a robot.

Open the Visual Studio Command Prompt as Administrator as described above.

```
mkdir c:\opt\chocolatey

set ChocolateyInstall=c:\opt\chocolatey

choco source add -n=ros-win -s="https://aka.ms/ros/public" --priority=1

choco upgrade ros-noetic-desktop_full -y --execution-timeout=0
```

8. Create a ROS Command Window shortcut

In order to use ROS on Windows, the ROS setup script needs to be called in each command Window. In order to not forget in the future, it is helpful to have a ROS shortcut which does this automatically.

- Create an Administrative command line shortcut for Visual Studio:
- Right click in a Windows Explorer folder, select New > Shortcut
- In the shortcut path, copy the highlighted command line from the following options, depending on the Visual Studio install above:
    - If you are using Community:

```
C:\Windows\System32\cmd.exe /k "C:\Program Files (x86)\Microsoft
Visual Studio\2019\Community\Common7\Tools\VsDevCmd.bat" -arch=am
d64 -host_arch=amd64&& set ChocolateyInstall=c:\opt\chocolatey&&
c:\opt\ros\noetic\x64\setup.bat
```

    - ~~If you are using Professional:~~

```
C:\Windows\System32\cmd.exe /k "C:\Program Files (x86)\Microsoft Visual Studio\2019\Professional\Common7\Tools\VsDevCmd.bat" -arch=amd64 -host_arch=amd64&& set ChocolateyInstall=c:\opt\chocolatey && c:\opt\ros\noetic\x64\setup.bat
```

- If you are using Enterprise:

```
C:\Windows\System32\cmd.exe /k "C:\Program Files (x86)\Microsoft Visual Studio\2019\Enterprise\Common7\Tools\VsDevCmd.bat" -arch=amd64 -host_arch=amd64&& set ChocolateyInstall=c:\opt\chocolatey&& c:\opt\ros\noetic\x64\setup.bat
```

- Name the shortcut "ROS"
- Set that shortcut as Administrator
  - Right Click on the shortcut and choose "Properties".
  - Select the Shortcut Tab if not already selected.
  - Press the Advanced button
  - Check the button "Run as Administrator".
  - Press OK on the Advanced properties dialog.
  - Press OK on the "ROS Properties" shortcut dialog.

9. Using the 'new' Windows Terminal

Microsoft released a new open source terminal for Windows, which includes many improvements over the built in command line, including tabs and appearance customization. You can install it from the Microsoft Store. (https://apps.microsoft.com/store/detail/windows-terminal/9N0DX20HK701?hl=en-us&gl=US)

ROS on Windows 10 Enterprise:

- Find the Windows Terminal from the start menu, right click and select 'Run as Administrator'
- Select settings from the drop down arrow next to the Add Tab (+) Button.
- In the list array in the "profiles" object, add a new block for ROS.

```
    "profiles" :
    {
        list:
        [
            ...
            {
                "commandline" : "C:\\Windows\\System32\\cmd.exe /k \"C:\\Program Files (x86)\\Microsoft Visual Studio\\2019\\Community\\Common7\\Tools\\VsDevCmd.bat\" -arch=amd64 -host_arch=amd64 && set ChocolateyInstall=c:\\opt\\chocolatey&& c:\\opt\\ros\\noetic\\x64\\setup.bat",
                "guid" : "{xxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxxxx}",
                "icon" : "ms-appx:///ProfileIcons/{0caa0dad-35be-5f56-a8ff-afceeeaa6101}.png",
                "name" : "ROS Noetic",
                "startingDirectory" : "c:\\ws"
        },
```

- from a Visual Studio command window, use the command `uuidgen` to generate a globally unique identifier (aka universally unique identifier).
- copy the guid (select the text, then right click to copy)
- Replace xxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxxxx with the text copied above.
- (Optionally) Set this guid as the "defaultProfile"

```
        "alwaysShowTabs" : true,
        "copyOnSelect" : false,
        "defaultProfile" : "{xxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxxxx}",
        ....
```

WINDOWS 10 HOME

You will need to manually configure the settings for ROS terminal. DON'T FORGET TO SAVE AFTER UPDATING SETTINGS.

Name: ROS

Command line:

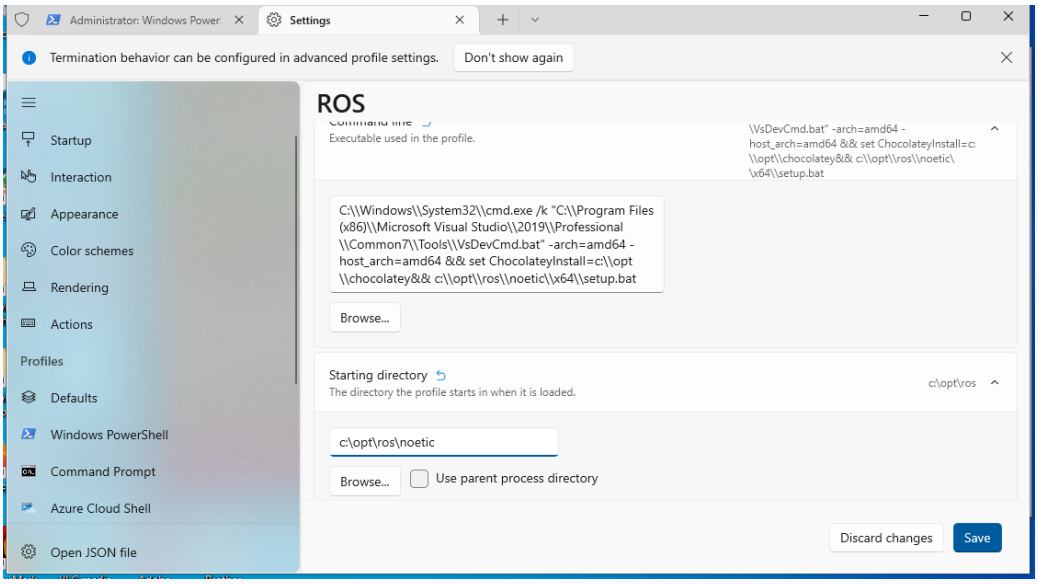
C:\\Windows\\System32\\cmd.exe /k "C:\\Program Files (x86)\\Microsoft Visual Studio\\2019\\Professional\\Common7\\Tools\\VsDevCmd.bat" -arch=amd64 -host_arch=amd64 && set ChocolateyInstall=c:\\opt\\chocolatey&& c:\\opt\\ros\\noetic\\x64\\setup.bat

Starting directory:

c:\opt\ros\noetic

Icon: (after expanding the image library zip in the folder) you can browse to what you want.

C:\Program Files (x86)\Microsoft Visual Studio 10.0\Common7\VS2010ImageLibrary\1033\VS2010ImageLibrary_Common Elements\Actions\Go.png



When launching the new Windows terminal, please remember to Run as Administrator, by right clicking on the Windows Terminal and Select *Run as Administrator*. There is a Always Run Terminal elevated feature request that needs to be implemented before this requirement is lifted.

Alternatively, Ctrl+Shift+clicking on the terminal icon in either the start menu or task bar is a handy shortcut to run as administrator.

10. Uninstall

1. Before the uninstallation, make sure no ROS system or program is running on your system.
2. In a command prompt, run the following command:

```
rmdir /s /q c:\opt
```

11. Stay Up to Date

If you want to update your ROS install, use Chocolatey's upgrade feature.

Open the ROS Command Prompt created above and approve the administrative elevation if not already opened.

Run the following command:

```
set ChocolateyInstall=c:\opt\chocolatey

choco upgrade all -y --execution-timeout=0
```

It is recommended to add `--execution-timeout=0` to accommodate a chocolatey install failure due to slow network.

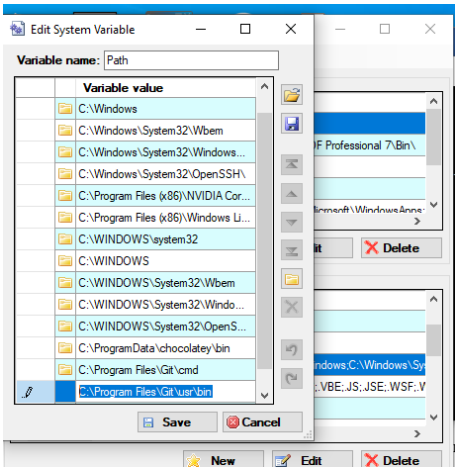
12. UNIX commands in Windows

While you are using Windows terminal it is nice to be able to use find, ls, other common unix commands. Plus, roslaunch may need 'cat' for some rosparam, so add gitbash https://gitforwindows.org/

Installed and found when run gitbash from Windows start menu:

```
$ where cat
C:\Program Files\Git\usr\bin\cat.exe
```

Add exe directory to Path environment variable, using EnvMan-1.2.2 and executed as administrator.



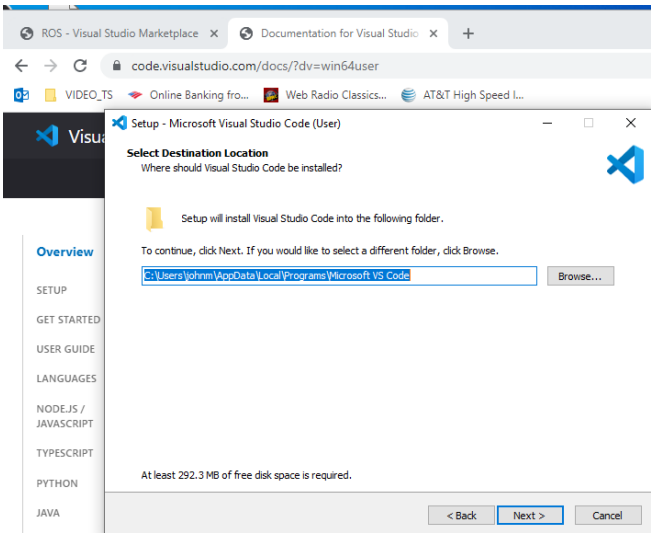
Make sure you restart your Windows terminal in case you couldn't find 'cat.exe' during roslaunch within gzpegboard.bat. It resets the Windows terminal environment variables, including PATH.

13. Feedback

In case you run into any upgrade/install/uninstall issues, you are encouraged to ask a question on answers.ros.org and tag `windows`. Don't hold your breath.

14. Installing Visual Code (VS) with ROS plugin

https://code.visualstudio.com/download# I selected user install 64 bit:
https://code.visualstudio.com/docs/?dv=win64user



Bring up vscode

Install extensions: Ctrl+Shift+X

Installed C++ plugins

Search and Install ROS plugin for Visual Code:

https://marketplace.visualstudio.com/items?itemName=ms-iot.vscode-ros

THIS IS A MUST FOR VS CODE TO WORK IN WINDOWS TERMINAL.

When in windows terminal:

```
**********************************************************************
** Visual Studio 2019 Developer Command Prompt v16.11.13
** Copyright (c) 2021 Microsoft Corporation
**********************************************************************

c:\opt\ros\noetic>x64\setup.bat

c:\opt\ros\noetic>cd hello_ws

c:\opt\ros\noetic\hello_ws>code .
```

Opens a vscode GUI in the given directory. Use “code .”.

Hit F1 or Alt-Shift-P to run extensions.

To format code: scroll to Format Document (or Selection) to format your C++ source file.

15. vcpkg installation

Not used, but some ROS installations are out of date (e.g., bzip) and you can use vcpkg to install and reference the latest. From: https://github.com/microsoft/vcpkg#quick-start-windows

```
c:\opt>git clone https://github.com/microsoft/vcpkg
c:\opt > .\vcpkg\bootstrap-vcpkg.bat
To install the libraries for your project, run:

> .\vcpkg\vcpkg install [packages to install]
Note: This will install x86 libraries by default. To install x64, run:

> .\vcpkg\vcpkg install [package name]:x64-windows
```

16. Running a Gazebo test

Installed the gzpegboard ROS workspace and then ran the following commands

```
c:\opt\ros\noetic>x64\setup.bat
c:\opt\ros\noetic>cd gzpegboard
c:\opt\ros\noetic\gzpegboard>cd bin
c:\opt\ros\noetic\gzpegboard\bin>gzpegboard.bat
```

Then after a while, the ROS master loads and you should then see the following gzpegboard Gazebo simulation:

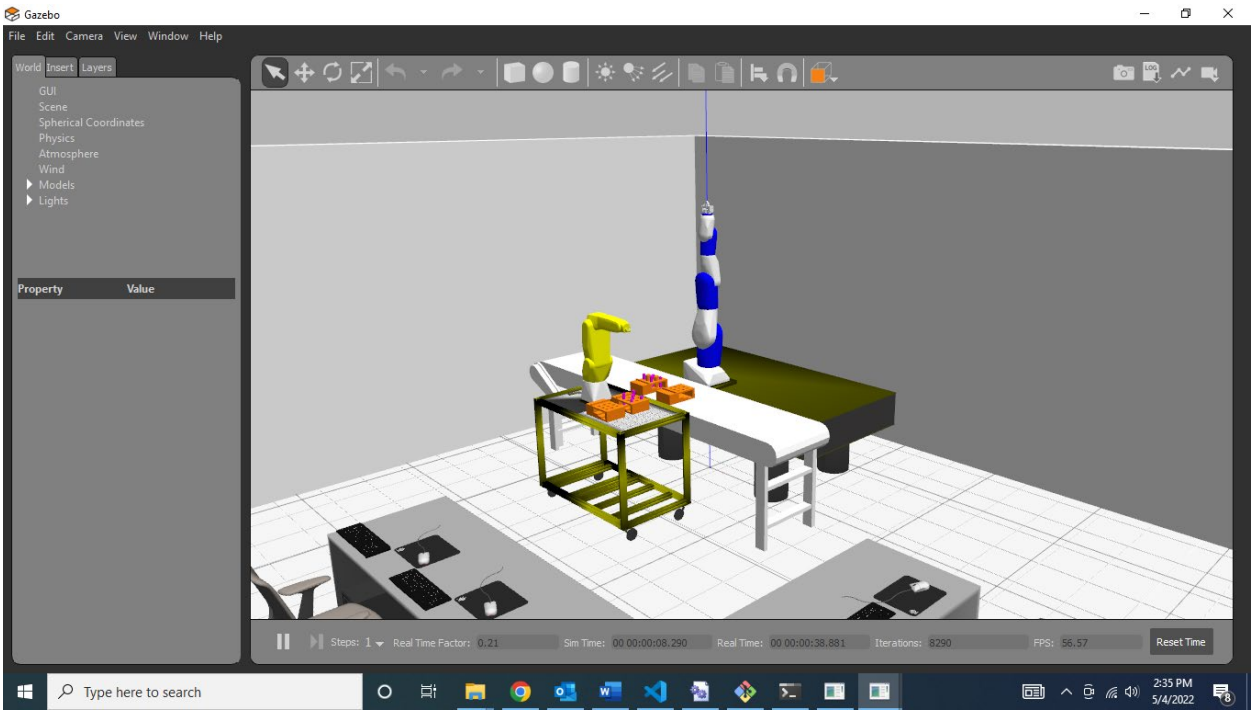


Figure 1 Gazebo Pegboard Display Windows 10 Home

Note, previous application of Gazebo textures in ROS on Windows failed so the terminals were removed. Note the cart under the Fanuc robot too has a yellow hue, which is not correct, but sufficient for the simulation work attempted.