

轮趣科技

ROS2 机器人源码编译教程

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版本说明:

版本	日期	内容说明
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网址: www.wheeltec.net

序言

本文档旨在帮助大家在不购买 WHEELTEC 整车的情况下，也能使用 WHEELTEC 的源码实现 ROS2 机器人导航。文档基于 galactic 版本把实现导航需要的全部依赖进行了说明，并提供了解决方案。

同时希望各位同学保持独立思考的习惯，很多问题都可以通过搜索引擎进行查找解决，例如编译报了 xxx 红色错误，一般搜索该 xxx 内容就可以看到解决方案。

Linux、Python、C++、ROS、STM32 等基础知识，在 B 站上也有大量优秀视频教程。

1. 编译过程

1.1 新建一个工作空间【wheeltec_ros2】

新建一个工作空间【wheeltec_ros2】，将源码 SRC 文件拷贝至 wheeltec_ros2 工作空间中。以 galactic 版本为例进行编译说明，如果用户使用其他版本的 ROS2 系统，需要将 galactic 更换为指定版本，如 foxy/humble。

1.2 运行 rosdep update

在系统环境中运行 rosdep init 后，运行 rosdep update。

```
wheeltec@galactic:~$ sudo rosdep init
Wrote /etc/ros/rosdep/sources.list.d/20-default.list
Recommended: please run

    rosdep update

wheeltec@galactic:~$ /etc/ros/rosdep/sources.list.d/20-default.list^C
wheeltec@galactic:~$ rosdep update
reading in sources list data from /etc/ros/rosdep/sources.list.d
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/osx-homebrew.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/base.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/python.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/rosdep/ruby.yaml
Hit https://raw.githubusercontent.com/ros/rosdistro/master/releases/fuerte.yaml
Query rosdistro index https://raw.githubusercontent.com/ros/rosdistro/master/index-v4.yaml
Skip end-of-life distro "ardent"
Skip end-of-life distro "bouncy"
Skip end-of-life distro "crystal"
Skip end-of-life distro "dashing"
Skip end-of-life distro "eloquent"
Add distro "foxy"
Skip end-of-life distro "galactic"
Skip end-of-life distro "groovy"
Add distro "humble"
Skip end-of-life distro "hydro"
Skip end-of-life distro "indigo"
Add distro "iron"
Skip end-of-life distro "jade"
Skip end-of-life distro "kinetic"
Skip end-of-life distro "lunar"
Add distro "melodic"
Add distro "noetic"
Add distro "rolling"
updated cache in /home/wheeltec/.ros/rosdep/sources.cache
wheeltec@galactic:~$
```

使用一键安装依赖指令，在工作空间文件夹路径下运行 rosdep 的一键安装依赖命令。注意工作空间文件夹不是 src 文件夹。在工作空间下运行以下命令可以安装绝大部分功能包依赖：

```
rosdep install --from-paths src --ignore-src -r -y
或
rosdep install --from-paths src --ignore-src -r -y --rosdistro galactic
```

```
wheeltec@galactic:~$ cd wheeltec_ros2/
wheeltec@galactic:~/wheeltec_ros2$ ls
src
wheeltec@galactic:~/wheeltec_ros2$ rosdep install --from-paths src --ignore-src -r -y --rosdistro galactic
ERROR: the following packages/stacks could not have their rosdep keys resolved
to system dependencies:
web_video_server: Cannot locate rosdep definition for [async_web_server_cpp]
nav2_smac_planner: Cannot locate rosdep definition for [ompl]
nav2_bt_navigator: Cannot locate rosdep definition for [behaviortree_cpp_v3]
nav2_behavior_tree: Cannot locate rosdep definition for [behaviortree_cpp_v3]
nav2_util: Cannot locate rosdep definition for [test_msgs]
nav2_system_tests: Cannot locate rosdep definition for [gazebo_ros_pkgs]
lsidar_driver: Cannot locate rosdep definition for [diagnostic_updater]
usb_cam: Cannot locate rosdep definition for [image_transport_plugins]
Continuing to install resolvable dependencies...
executing command [sudo -H apt-get install -y ffmpeg]
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
正在读取状态信息... 完成
建议安装：
  ffmpeg-doc
下列【新】软件包将被安装：
  ffmpeg
升级了 0 个软件包，新安装了 1 个软件包，要卸载 0 个软件包，有 982 个软件包未被升级。
需要下载 1,453 kB 的归档。
解压后会消耗 2,063 kB 的额外空间。
0% [正在连接 mirrors.aliyun.com]
```

运行完成后会显示#all required rosdeps installed successfully

```
解压后会消耗 2,274 kB 的额外空间。
获取:1 http://mirrors.aliyun.com/ubuntu focal/main amd64 libv4l2rds0 amd64 1.18.0-2build1 [15.8 kB]
获取:2 http://mirrors.aliyun.com/ubuntu focal/universe amd64 v4l-utils amd64 1.18.0-2build1 [586 kB]
已下载 602 kB，耗时 10秒 (57.5 kB/s)
正在选中未选择的软件包 libv4l2rds0:amd64。
(正在读取数据库 ... 系统当前共安装有 274349 个文件和目录。)
准备解压 .../libv4l2rds0_1.18.0-2build1_amd64.deb ...
正在解压 libv4l2rds0:amd64 (1.18.0-2build1) ...
正在选中未选择的软件包 v4l-utils。
准备解压 .../v4l-utils_1.18.0-2build1_amd64.deb ...
正在解压 v4l-utils (1.18.0-2build1) ...
正在设置 libv4l2rds0:amd64 (1.18.0-2build1) ...
正在设置 v4l-utils (1.18.0-2build1) ...
正在处理用于 libc-bin (2.31-0ubuntu9.9) 的触发器 ...
正在处理用于 man-db (2.9.1-1) 的触发器 ...
#All required rosdeps installed successfully
wheeltec@galactic:~/wheeltec_ros2$
```

1.3 关于二进制安装的功能包

在 wheeltec_ros2 中，二进制安装的功能包有：

usb_cam-ros2: 在 ROS 中使用 UVC 协议的相机功能包

```
sudo apt install ros-galactic-usb-cam
```

joint-state-publisher: 发布机器人的关节状态

```
sudo apt install ros-galactic-joint-state-publisher*
```

robot-localization: 基于卡尔曼滤波在 ROS 系统上比较成熟、应用比较广泛的一个机器人动态定位软件包。

```
sudo apt install ros-galactic-robot-localization*
```

web_video_server-ros2: 网络视频服务器，在 ROS 中启动相机，运行网络视频服务器后可以在浏览器中查看相机实时图像。

```
sudo apt install ros-galactic-async-web-server-cpp*
```

wheeltec_robot_rtab:RTAB 算法建图，可获取 3D 视觉点云

```
sudo apt install ros-galactic-rtab*
```

wheeltec_cartographer:cartographer 算法建图

```
sudo apt install ros-galactic-cartographer*
```

wheeltec_slam_toolbox:slam_toolbox 算法建图

```
sudo apt install ros-galactic-slam-toolbox*
```

1.4 编译以及报错解决

主要是安装一些 rosdep 遗漏的依赖，如果是拷贝了整个 wheeltec_ros2/src 源码，则需要安装以下依赖：

```
sudo apt install ros-galactic-test-msgs* -y
sudo apt install ros-galactic-behaviortree-cpp-v3* -y
sudo apt install ros-galactic-ompl -y
sudo apt install ros-galactic-async-web-server-cpp* -y
sudo apt install ros-galactic-filters -y
sudo apt install ros-galactic-diagnostic-updater
sudo apt install ros-galactic-gazebo-ros-pkgs -y
```

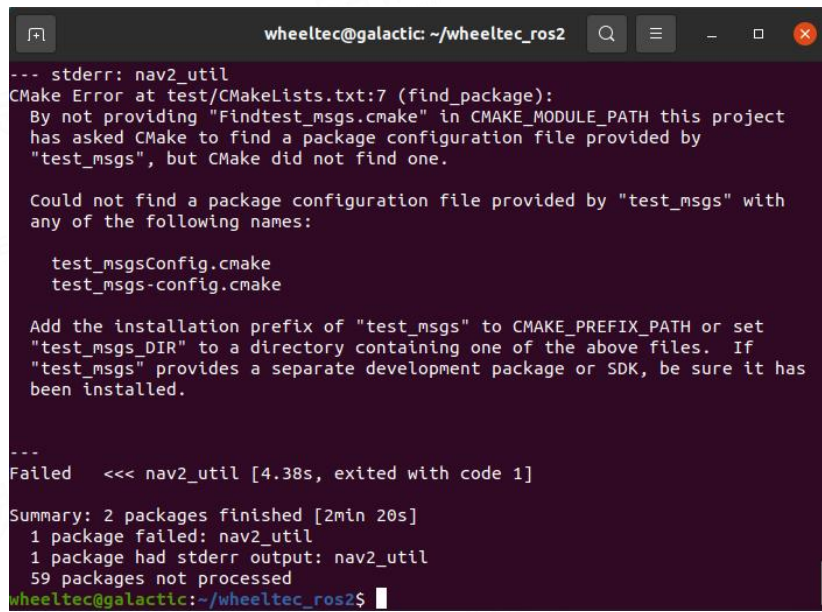
若使用某个功能包出现报错，可以根据下面的解决方法进行编译。

在工作空间目录下运行编译指令：

```
cd ~/wheeltec_ros2
colcon build
```

出现报错：

```
Could not find a package configuration file provided by "test_msgs" with
any of the following names:
```



```
wheeltec@galactic: ~/wheeltec_ros2
--- stderr: nav2_util
CMake Error at test/CMakeLists.txt:7 (find_package):
  By not providing "Findtest_msgs.cmake" in CMAKE_MODULE_PATH this project
  has asked CMake to find a package configuration file provided by
  "test_msgs", but CMake did not find one.

  Could not find a package configuration file provided by "test_msgs" with
  any of the following names:

    test_msgsConfig.cmake
    test_msgs-config.cmake

  Add the installation prefix of "test_msgs" to CMAKE_PREFIX_PATH or set
  "test_msgs_DIR" to a directory containing one of the above files.  If
  "test_msgs" provides a separate development package or SDK, be sure it has
  been installed.

---
Failed   <<< nav2_util [4.38s, exited with code 1]
Summary: 2 packages finished [2min 20s]
 1 package failed: nav2_util
 1 package had stderr output: nav2_util
59 packages not processed
wheeltec@galactic:~/wheeltec_ros2$
```

解决办法，安装 test-msgs 依赖：

```
sudo apt install ros-galactic-test-msgs*
```

```
wheeltec@galactic:~/wheeltec_ros2$ sudo apt install ros-galactic-test-msgs*
[sudo] password for wheeltec:
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
正在读取状态信息... 完成
注意, 根据Glob 'ros-galactic-test-msgs*' 选中了 'ros-galactic-test-msgs-dbgsym'
注意, 根据Glob 'ros-galactic-test-msgs*' 选中了 'ros-galactic-test-msgs'
下列【新】软件包将被安装:
  ros-galactic-test-msgs ros-galactic-test-msgs-dbgsym
升级了 0 个软件包, 新安装了 2 个软件包, 要卸载 0 个软件包, 有 982 个软件包未
被升级。
需要下载 4,446 kB 的归档。
解压后会消耗 9,931 kB 的额外空间。
获取:1 http://packages.ros.org/ros2/ubuntu focal/main amd64 ros-galactic-test
-msgs amd64 1.0.3-2focal.20221203.094942 [347 kB]
获取:2 http://packages.ros.org/ros2/ubuntu focal/main amd64 ros-galactic-test
-msgs-dbgsym amd64 1.0.3-2focal.20221203.094942 [4,100 kB]
24% [2 ros-galactic-test-msgs-dbgsym 415 kB/4,100 kB 10%] 82.3 kB/s 44秒
```

安装完成后, 继续编译:

colcon build

出现错误:

Could not find a package configuration file provided by
"behaviortree_cpp_v3" with any of the following names:

```
wheeltec@galactic: ~/wheeltec_ros2
--- stderr: nav2_behavior_tree
CMake Error at CMakeLists.txt:14 (find_package):
  By not providing "Findbehaviortree_cpp_v3.cmake" in CMAKE_MODULE_PATH this
  project has asked CMake to find a package configuration file provided by
  "behaviortree_cpp_v3", but CMake did not find one.

Could not find a package configuration file provided by
"behaviortree_cpp_v3" with any of the following names:

  behaviortree_cpp_v3Config.cmake
  behaviortree_cpp_v3-config.cmake

Add the installation prefix of "behaviortree_cpp_v3" to CMAKE_PREFIX_PATH
or set "behaviortree_cpp_v3_DIR" to a directory containing one of the above
files.  If "behaviortree_cpp_v3" provides a separate development package or
SDK, be sure it has been installed.

---
Failed <<< nav2_behavior_tree [2.00s, exited with code 1]

Summary: 7 packages finished [4min 30s]
 1 package failed: nav2_behavior_tree
 1 package had stderr output: nav2_behavior_tree
 54 packages not processed
wheeltec@galactic:~/wheeltec_ros2$
```

解决方法, 安装 behaviortree-cpp-v3 依赖:

sudo apt install ros-galactic-behaviortree-cpp-v3*

```
wheeltec@galactic:~/wheeltec_ros2$ sudo apt install ros-galactic-behaviortree
-cpp-v3* -y
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
正在读取状态信息... 完成
注意, 根据Glob 'ros-galactic-behaviortree-cpp-v3*' 选中了 'ros-galactic-behav
iortree-cpp-v3-dbgsym'
注意, 根据Glob 'ros-galactic-behaviortree-cpp-v3*' 选中了 'ros-galactic-behav
iortree-cpp-v3'
将会同时安装下列软件:
  libncurses-dev libncurses5-dev libncurses6 libncursesw6 libtinfo6
建议安装:
  ncurses-doc
下列【新】软件包将被安装:
  libncurses-dev libncurses5-dev ros-galactic-behaviortree-cpp-v3
  ros-galactic-behaviortree-cpp-v3-dbgsym
下列软件包将被升级:
  libncurses6 libncursesw6 libtinfo6
升级了 3 个软件包, 新安装了 4 个软件包, 要卸载 0 个软件包, 有 979 个软件包未
被升级。
需要下载 7,305 kB 的归档。
解压后会消耗 10.5 MB 的额外空间。
获取:1 http://mirrors.aliyun.com/ubuntu focal-security/main amd64 libncursesw
6 amd64 6.2-0ubuntu2.1 [132 kB]
获取:2 http://mirrors.aliyun.com/ubuntu focal-security/main amd64 libncurses6
```

安装完成后继续编译，出现报错：

Could not find a package configuration file provided by "ompl" with any of the following names:

```
--- stderr: nav2_smac_planner
CMake Error at CMakeLists.txt:24 (find_package):
  By not providing "Findompl.cmake" in CMAKE_MODULE_PATH this project has
  asked CMake to find a package configuration file provided by "ompl", but
  CMake did not find one.

Could not find a package configuration file provided by "ompl" with any of
the following names:

  omplConfig.cmake
  ompl-config.cmake

Add the installation prefix of "ompl" to CMAKE_PREFIX_PATH or set
"ompl_DIR" to a directory containing one of the above files. If "ompl"
provides a separate development package or SDK, be sure it has been
installed.

---
Failed <<< nav2_smac_planner [4.19s, exited with code 1]

Summary: 24 packages finished [33min 29s]
 1 package failed: nav2_smac_planner
 1 package had stderr output: nav2_smac_planner
37 packages not processed
wheeltec@galactic:~/wheeltec_ros2$
```

解决方法：安装 ompl 依赖

`sudo apt install ros-galactic-ompl -y`

```
wheeltec@galactic:~/wheeltec_ros2$ sudo apt install ros-galactic-ompl -y
[sudo] password for wheeltec:
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
正在读取状态信息... 完成
下列【新】软件包将被安装：
  ros-galactic-ompl
升级了 0 个软件包，新安装了 1 个软件包，要卸载 0 个软件包，有 979 个软件包未
被升级。
需要下载 1,776 kB 的归档。
解压缩后会消耗 10.3 MB 的额外空间。
获取:1 http://packages.ros.org/ros2/ubuntu focal/main amd64 ros-galactic-ompl
amd64 1.5.2-1focal.20221203.081504 [1,776 kB]
37% [1 ros-galactic-ompl 825 kB/1,776 kB 46%]
```

安装完成后继续编译，出现报错：

project has asked CMake to find a package configuration file provided by "async_web_server_cpp", but CMake did not find one

```
Starting >>> web_video_server
--- stderr: web_video_server
CMake Error at CMakeLists.txt:6 (find_package):
  By not providing "Findasync_web_server_cpp.cmake" in CMAKE_MODULE_PATH thi
s
  project has asked CMake to find a package configuration file provided by
  "async_web_server_cpp", but CMake did not find one.

Could not find a package configuration file provided by
"async_web_server_cpp" with any of the following names:

  async_web_server_cppConfig.cmake
  async_web_server_cpp-config.cmake

Add the installation prefix of "async_web_server_cpp" to CMAKE_PREFIX_PATH
or set "async_web_server_cpp_DIR" to a directory containing one of the
above files. If "async_web_server_cpp" provides a separate development
package or SDK, be sure it has been installed.

---
Failed <<< web_video_server [0.72s, exited with code 1]

Summary: 45 packages finished [10min 53s]
 1 package failed: web_video_server
```

解决办法:

```
sudo apt install ros-galactic-async-web-server-cpp* -y
```

```
wheeltec@galactic:~/wheeltec_ros2$  
wheeltec@galactic:~/wheeltec_ros2$ sudo apt install ros-galactic-async-web-s  
server-cpp* -y  
[sudo] password for wheeltec:  
Sorry, try again.  
[sudo] password for wheeltec:  
正在读取软件包列表... 完成  
正在分析软件包的依赖关系树  
正在读取状态信息... 完成  
注意, 根据Glob 'ros-galactic-async-web-server-cpp*' 选中了 'ros-galactic-asy  
nc-web-server-cpp-dbgsym'  
注意, 根据Glob 'ros-galactic-async-web-server-cpp*' 选中了 'ros-galactic-asy  
nc-web-server-cpp'  
下列【新】软件包将被安装:  
  ros-galactic-async-web-server-cpp  
  ros-galactic-async-web-server-cpp-dbgsym  
升级了 0 个软件包, 新安装了 2 个软件包, 要卸载 0 个软件包, 有 979 个软件包未  
被升级。  
需要下载 3,194 kB 的归档。  
解压后会消耗 3,843 kB 的额外空间。  
获取:1 http://packages.ros.org/ros2/ubuntu focal/main amd64 ros-galactic-asy  
nc-web-server-cpp amd64 2.0.0-2focal.20221203.084647 [153 kB]  
获取:2 http://packages.ros.org/ros2/ubuntu focal/main amd64 ros-galactic-asy  
nc-web-server-cpp-dbgsym amd64 2.0.0-2focal.20221203.084647 [3,041 kB]  
79% [2 ros-galactic-async-web-server-cpp-dbgsym 2,613 kB/3,041 kB 86%] [B
```

安装完成后继续编译, 出现报错:

```
Could not find a package configuration file provided by "filters" with any  
of the following names:
```

```
wheeltec@galactic: ~/wheeltec_ros2  
-- stderr: wheeltec_robot_rrt  
Make Error at CMakeLists.txt:21 (find_package):  
By not providing "Findfilters.cmake" in CMAKE_MODULE_PATH this project has  
asked CMake to find a package configuration file provided by "filters", bu  
CMake did not find one.  
  
Could not find a package configuration file provided by "filters" with any  
of the following names:  
  
  filtersConfig.cmake  
  filters-config.cmake  
  
Add the installation prefix of "filters" to CMAKE_PREFIX_PATH or set  
"filters_DIR" to a directory containing one of the above files. If  
"filters" provides a separate development package or SDK, be sure it has  
been installed.  
  
--  
alled <<< wheeltec_robot_rrt [1.63s, exited with code 1]  
  
Summary: 49 packages finished [2min 26s]  
1 package failed: wheeltec_robot_rrt  
5 packages had stderr output: nav2_gazebo_spawner tf2_tools web_video_serv
```

解决办法: 安装 filters 依赖

```
sudo apt install ros-galactic-filters -y
```

```
wheeltec@galactic:~/wheeltec_ros2$ sudo apt install ros-galactic-filters -y  
[sudo] password for wheeltec:  
正在读取软件包列表... 完成  
正在分析软件包的依赖关系树  
正在读取状态信息... 完成  
下列【新】软件包将被安装:  
  ros-galactic-filters  
升级了 0 个软件包, 新安装了 1 个软件包, 要卸载 0 个软件包, 有 979 个软件包未  
被升级。  
需要下载 64.7 kB 的归档。  
解压后会消耗 449 kB 的额外空间。  
获取:1 http://packages.ros.org/ros2/ubuntu focal/main amd64 ros-galactic-fil  
ters amd64 2.1.0-1focal.20221207.100603 [64.7 kB]  
0% [1 ros-galactic-filters 0 B/64.7 kB 0%]
```

继续编译, 出现报错:

Could not find a package configuration file provided by "wheeltec_rrt_msg" with any of the following names:

```
By not providing "Findwheeltec_rrt_msg.cmake" in CMAKE_MODULE_PATH this project has asked CMake to find a package configuration file provided by "wheeltec_rrt_msg", but CMake did not find one.

Could not find a package configuration file provided by "wheeltec_rrt_msg" with any of the following names:

  wheeltec_rrt_msgConfig.cmake
  wheeltec_rrt_msg-config.cmake

Add the installation prefix of "wheeltec_rrt_msg" to CMAKE_PREFIX_PATH or set "wheeltec_rrt_msg_DIR" to a directory containing one of the above files. If "wheeltec_rrt_msg" provides a separate development package or SDK, be sure it has been installed.

--
failed <<< wheeltec_robot_rrt [0.73s, exited with code 1]

Summary: 49 packages finished [42.9s]
1 package failed: wheeltec_robot_rrt
4 packages had stderr output: nav2_gazebo_spawner tf2_tools wheeltec_robot_keyboard wheeltec_robot_rrt
12 packages not processed
wheeltec@galactic:~/wheeltec_ros2$
```

解决办法:

单独编译 wheeltec_rrt_msg 功能包，使系统获得自定义的 msg

```
colcon build --packages-select wheeltec_rrt_msg
```

编译完成后运行 source install/setup.bash，使工作空间的环境变量生效，使用 ros2 interface list -m 命令可以查看到 wheeltec_rrt_msg 的内容:

```
visualization_msgs/msg/ImageMarker
visualization_msgs/msg/InteractiveMarker
visualization_msgs/msg/InteractiveMarkerControl
visualization_msgs/msg/InteractiveMarkerFeedback
visualization_msgs/msg/InteractiveMarkerInit
visualization_msgs/msg/InteractiveMarkerPose
visualization_msgs/msg/InteractiveMarkerUpdate
visualization_msgs/msg/Marker
visualization_msgs/msg/MarkerArray
visualization_msgs/msg/MenuEntry
wheeltec_robot_msg/msg/Data
wheeltec_rrt_msg/msg/PointArray
wheeltec@galactic:~/wheeltec_ros2$
```

继续编译功能包:

出现报错:

Could not find a package configuration file provided by "diagnostic_updater" with any of the following names:

```
wheeltec@galactic: ~/wheeltec_ros2
project has asked CMake to find a package configuration file provided by "diagnostic_updater", but CMake did not find one.

Could not find a package configuration file provided by "diagnostic_updater" with any of the following names:

  diagnostic_updaterConfig.cmake
  diagnostic_updater-config.cmake
```

解

决办法: 安装 diagnostic-updater 依赖

```
sudo apt install ros-galactic-diagnostic-updater
```

```
wheeltec@galactic: ~/wheeltec_ros2$ sudo apt-get install ros-galactic-diagnostic-updater
[sudo] password for wheeltec:
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
正在读取状态信息... 完成
下列【新】软件包将被安装：
  ros-galactic-diagnostic-updater
升级了 0 个软件包，新安装了 1 个软件包，要卸载 0 个软件包，有 974 个软件包未被升级。
需要下载 91.6 kB 的归档。
解压缩后会消耗 408 kB 的额外空间。
获取:1 http://packages.ros.org/ros2/ubuntu focal/main amd64 ros-galactic-diagnostic-updater amd64 2.1.3-1focal.20221207.073007 [91.6 kB]
已下载 91.6 kB，耗时 2秒 (54.8 kB/s)
正在选中未选择的软件包 ros-galactic-diagnostic-updater。
(正在读取数据库 ... 系统当前共安装有 276400 个文件和目录。)
准备解压 .../ros-galactic-diagnostic-updater_2.1.3-1focal.20221207.073007_amd64.deb ...
正在解压 ros-galactic-diagnostic-updater (2.1.3-1focal.20221207.073007) ...
正在设置 ros-galactic-diagnostic-updater (2.1.3-1focal.20221207.073007) ...
```

继续编译功能包：

出现报错：

ModuleNotFoundError: No module named 'ament_package'

```
wheeltec@galactic: ~/wheeltec_ros2
Finished <<< wheeltec_slam_toolbox [0.28s]
Starting >>> astra_camera
Finished <<< astra_camera [0.90s]
Starting >>> lsliar_driver
--- stderr: lsliar_driver
Traceback (most recent call last):
  File "/opt/ros/galactic/share/ament_cmake_core/cmake/package_templates/templates_2_cmake.py", line 21, in <module>
    from ament_package_templates import get_environment_hook_template_path
ModuleNotFoundError: No module named 'ament_package'
CMake Error at /opt/ros/galactic/share/ament_cmake_core/cmake/ament_cmake_package_templates-extras.cmake:41 (message):
  execute_process(/usr/bin/python3
    /opt/ros/galactic/share/ament_cmake_core/cmake/package_templates/templates_2_cmake.py
    /home/wheeltec/wheeltec_ros2/build/lsliar_driver/ament_cmake_package_templates/templates.cmake)
  returned error code 1
Call Stack (most recent call first):
  /opt/ros/galactic/share/ament_cmake_core/cmake/ament_cmake_coreConfig.cmake:41 (include)
  /opt/ros/galactic/share/rcldcpp/cmake/ament_cmake_export_include_directories-extras.cmake:8 (find_package)
  /opt/ros/galactic/share/rcldcpp/cmake/rcldcppConfig.cmake:41 (include)
  CMakeLists.txt:20 (find_package)
```

解决办法：这里的报错是因为系统没有识别到 galactic 环境，需要 source 一遍环境变量，运行以下指令：

source /opt/ros/galactic/setup.bash

或在 ~/.bashrc 文件中增加一句：‘source /opt/ros/galactic/setup.bash’

```
wheeltec@galactic: ~/wheeltec_ros2
GNU nano 4.8 /home/wheeltec/.bashrc Modified
# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
. ~/.bash_aliases
fi

# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
. /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
. /etc/bash_completion
  fi
fi
source /opt/ros/galactic/setup.bash

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify
^X Exit ^R Read File ^_ Replace ^U Paste Text ^T To Spell
```

增加后在终端输入：source ~/.bashrc 即可

继续编译功能包：

出现报错：

Could not find a package configuration file provided by "gazebo_ros_pkgs"
with any of the following names:

```
CMake Error at CMakeLists.txt:17 (find_package):
  By not providing "Findgazebo_ros_pkgs.cmake" in CMAKE_MODULE_PATH this
  project has asked CMake to find a package configuration file provided by
  "gazebo_ros_pkgs", but CMake did not find one.

Could not find a package configuration file provided by "gazebo_ros_pkgs"
with any of the following names:

  gazebo_ros_pkgsConfig.cmake
  gazebo_ros_pkgs-config.cmake

Add the installation prefix of "gazebo_ros_pkgs" to CMAKE_PREFIX_PATH or
set "gazebo_ros_pkgs_DIR" to a directory containing one of the above files.
If "gazebo_ros_pkgs" provides a separate development package or SDK, be
sure it has been installed.

...
Failed   <<< nav2_system_tests [4.13s, exited with code 1]

Summary: 60 packages finished [1min 50s]
 1 package failed: nav2_system_tests
 8 packages had stderr output: lsldar_driver nav2_gazebo_spawner nav2_simple_com
mander nav2_system_tests simple_follower_ros2 slam_gmapping tf2_tools wheeltec_ro
bot_keyboard
 1 package not processed
wheeltec@galactic:~/wheeltec_ros2$ sudo apt install ros-galactic-gazebo-ros
```

解决方法：安装 gazebo-ros-pkgs 依赖

sudo apt install ros-gazebo-ros-pkgs -y

```
wheeltec@galactic:~/wheeltec_ros2$ sudo apt install ros-galactic-gazebo-ros-pkgs -y
正在读取软件包列表... 完成
正在分析软件包的依赖关系树
正在读取状态信息... 完成
将会同时安装下列软件：
gazebo11 gazebo11-plugin-base libgazebo11 libgazebo11-dev
libignition-cmake2-dev libignition-math6 libignition-math6-dev libsdformat9
libsdformat9-dev ros-galactic-gazebo-dev ros-galactic-gazebo-plugins
ros-galactic-gazebo-ros sdfformat9-sdf
建议安装：
gazebo11-doc
下列【新】软件包将被安装：
ros-galactic-gazebo-dev ros-galactic-gazebo-plugins ros-galactic-gazebo-ros
ros-galactic-gazebo-ros-pkgs
下列软件包将被升级：
gazebo11 gazebo11-plugin-base libgazebo11 libgazebo11-dev
libignition-cmake2-dev libignition-math6 libignition-math6-dev libsdformat9
libsdformat9-dev sdfformat9-sdf
升级了 10 个软件包，新安装了 4 个软件包，要卸载 0 个软件包，有 964 个软件包未被升级。
需要下载 18.5 MB 的归档。
解压缩后会消耗 17.7 MB 的额外空间。
0% [执行中]
```

继续编译功能包：

出现报错：

Could not find a package configuration file provided by "bondopp" with any of the following nanes

```
Starting >>> turn_on_wheeltec_robot
Starting >>> orb_slam2_ros
Finished <<< ldlidar_sl_ros2 [1.07s]
Finished <<< ldlidar_sl_ros2 [1.08s]
Starting >>> qt_ros_test
Starting >>> tf2_tools
Finished <<< auto_recharge_ros2 [2.25s]
Starting >>> tts
--- stderr: nav2_util
CMake Error at CMakeLists.txt:17 (find_package):
  By not providing "Findbondopp.cmake" in CMAKE_MODULE_PATH this project has
  asked CMake to find a package configuration file provided by "bondopp", but
  CMake did not find one.

Could not find a package configuration file provided by "bondopp" with any
of the following names:
  bondoppconfig.cmake
  bondopp-config.cmake

Add the installation prefix of "bondopp" to CMAKE_PREFIX_PATH or set
"bondopp_DIR" to a directory containing one of the above files.  If
"bondopp" provides a separate development package or SDK, be sure it has
been installed.
```

解决方法：安装 bondopp 依赖

sudo apt-get install ros-humble-bondcpp

继续编译功能包：

出现报错：

Could not find a package configuration file provided by "image_common" with any of the following names


```
nfo.cpp:14:10: fatal error: nlohmann/json.hpp: No such file or directory
```

```
14 | #include <nlohmann/json.hpp>
```

```
By not providing "Findglog.cmake" in CMAKE_MODULE_PATH this project has
asked CMake to find a package configuration file provided by "glog", but
CMake did not find one.
```

```
Could not find a package configuration file provided by "glog" with any of
the following names:
```

```
glogConfig.cmake
glog-config.cmake
```

```
wheeltec@galactic: ~/wheeltec_ros2
has asked CMake to find a package configuration file provided by
"magic_enum", but CMake did not find one.
Could not find a package configuration file provided by "magic_enum" with
any of the following names:
magic_enumConfig.cmake
magic_enum-config.cmake
```

```
--- stderr: astra_camera
/home/wheeltec/wheeltec_ros2/src/ros2_astra_camera/astra_camera/src/ob_camera_info.cpp:14:10: fatal error: nlohmann/json.hpp: No such file or directory
14 | #include <nlohmann/json.hpp>
    |
compilation terminated.
make[2]: *** [CMakeFiles/astra_camera.dir/build.make:115: CMakeFiles/astra_camera.dir/src/ob_camera_info.cpp.o] Error 1
make[1]: *** [CMakeFiles/Makefile2:80: CMakeFiles/astra_camera.dir/all] Error 2
make: *** [Makefile:141: all] Error 2
```

所以编译奥比相机 SDK 前需要先安装依赖:

step1:

```
sudo apt install libgflags-dev nlohmann-json3-dev \
ros-galactic-image-transport ros-galactic-image-publisher
```

step2:安装 glog 依赖

```
cd ~
wget -c https://github.com/google/glog/archive/refs/tags/v0.6.0.tar.gz -O
glog-0.6.0.tar.gz
tar -xzf glog-0.6.0.tar.gz
cd glog-0.6.0
mkdir build && cd build
cmake .. && make -j4
sudo make install
sudo ldconfig
```

step3:安装 magic_enum 依赖

```
cd ~
wget -c
https://github.com/Neargye/magic_enum/archive/refs/tags/v0.8.0.tar.gz -O
```

```
magic_enum-0.8.0.tar.gz
tar -xzf magic_enum-0.8.0.tar.gz
cd magic_enum-0.8.0
mkdir build && cd build
cmake .. && make -j4
sudo make install
sudo ldconfig # Refreshing the link library
```

step4: 安装 libuvc 依赖

```
git clone https://github.com/libuv/libuv.git
cd libuv
mkdir build && cd build
cmake .. && make -j4
sudo make install
sudo ldconfig # Refreshing the link library
```

step5:

```
cd ~/wheeltec_ros2/src/ros2_astra_camera/astra_camera/scripts
sudo bash install.sh
sudo udevadm control --reload-rules && sudo udevadm trigger
```

step6:编译相机 SDK

```
cd ~/wheeltec_ws
source /opt/ros/galactic/setup.bash
colcon build --packages-select astra_camera_msgs
colcon build --packages-select astra_camera
```

出现报错:

```
Target "astra_camera" links to target "LibUVC::UVCSHARED" but the target
was not found. Perhaps a find_package() call is missing for an IMPORTED
target, or an ALIAS target is missing?
```

```
--- stderr: astra_camera
CMake Error at CMakeLists.txt:83 (add_library):
  Target "astra_camera" links to target "LibUVC::UVCSHARED" but the target
  was not found. Perhaps a find_package() call is missing for an IMPORTED
  target, or an ALIAS target is missing?

CMake Error at CMakeLists.txt:119 (add_executable):
  Target "list_devices_node" links to target "LibUVC::UVCSHARED" but the
  target was not found. Perhaps a find_package() call is missing for an
  IMPORTED target, or an ALIAS target is missing?
```

解决办法,修改 ros2_astra_camera/astra_camera 文件夹下的 CMakeLists.txt,
将 LibUVC::UVCSHARED 修改为 \${libuvc_LIBRARIES}, 保存后编译即可。

```

CMakeLists.txt
~/wheeltec_ros2/src/ros2_astra_camera/astra_camera

131 )
132 target_link_libraries(list_devices_node
133   ${OpenCV_LIBS}
134   Eigen3::Eigen
135   glog::glog
136   magic_enum::magic_enum
137   #LibUVC::UVCShared
138   ${libuvc_LIBRARIES}
139   -lOpenNI2
140   -L${ORB_SLAM3_OPENNI2_REDIST}
141   ${PROJECT_NAME}
142 )
143
144 target_compile_definitions(${PROJECT_NAME} PRIVATE "COMPOSITION_BUILDING_DLL")
145
146 rclcpp_components_register_nodes(${PROJECT_NAME}
147   "${PROJECT_NAME}::PointCloudXyzrgbNode"
148   "${PROJECT_NAME}::PointCloudXyzNode"
149   "${PROJECT_NAME}::OBCameraNodeFactory")
150
151 install(TARGETS ${PROJECT_NAME}
152   ARCHIVE DESTINATION lib
153   LIBRARY DESTINATION lib
154   RUNTIME DESTINATION bin
155 )
156
  
```

Saving file "/home/wheeltec/wheeltec_ros2/src/ro... CMake Tab Width: 8 Ln 143, Col 1 INS

1.6 轮趣系统环境的编译顺序要求

由于目前环境内二进制安装与源码编译安装的功能包共存（主要为 nav2 系列功能包），需要按以下步骤编译，否则会出现以下报错。

```

Stderr: nav2_mppi_controller.....
Generator.initialize(settings, false)....
  
```

```

Finished <<< simple_follower_ros2 [5.10s]
--- stderr: nav2_mppi_controller
/home/wheeltec/wheeltec_test_ros2/src/navigation2-humble/nav2_mppi_controller/test/noise_generator_test.cpp: In member function 'virtual void NoiseGeneratorTest_NoiseGeneratorLifecycleTest::TestInitializeSettings6, bool)':
/home/wheeltec/wheeltec_test_ros2/src/navigation2-humble/nav2_mppi_controller/test/noise_generator_test.cpp:45:23: error: no matching function for call to 'mppi::NoiseGenerator::initialize(mppi::models::OptimizerSettings6, bool)'
45 |     generator.initialize(settings, false);
    |     ~~~~~^~~~~~
In file included from /home/wheeltec/wheeltec_test_ros2/src/navigation2-humble/nav2_mppi_controller/test/noise_generator_test.cpp:20:
/opt/ros/humble/include/nav2_mppi_controller/tools/noise_generator.hpp:54:8: note: candidate: 'void mppi::NoiseGenerator::initialize(mppi::models::OptimizerSettings6, bool, const std::string&)'
54 | void initialize(
    | ~~~~~^~~~~~
/opt/ros/humble/include/nav2_mppi_controller/tools/noise_generator.hpp:54:8: note: candidate expects 4 arguments, 2 provided
/home/wheeltec/wheeltec_test_ros2/src/navigation2-humble/nav2_mppi_controller/test/noise_generator_test.cpp: In member function 'virtual void NoiseGeneratorTest_NoiseGeneratorMainTest::TestInitializeSettings6, bool)':
/home/wheeltec/wheeltec_test_ros2/src/navigation2-humble/nav2_mppi_controller/test/noise_generator_test.cpp:73:23: error: no matching function for call to 'mppi::NoiseGenerator::initialize(mppi::models::OptimizerSettings6, bool)'
73 |     generator.initialize(settings, false);
    |     ~~~~~^~~~~~
In file included from /home/wheeltec/wheeltec_test_ros2/src/navigation2-humble/nav2_mppi_controller/test/noise_generator_test.cpp:20:
/opt/ros/humble/include/nav2_mppi_controller/tools/noise_generator.hpp:54:8: note: candidate: 'void mppi::NoiseGenerator::initialize(mppi::models::OptimizerSettings6, bool, const std::string&)'
54 | void initialize(
    | ~~~~~^~~~~~
  
```

- 先卸载 mppi 路径规划：
 sudo apt autoremove ros-humble-nav2-mppi-controller
- 再编译：colcon build
- 再安装 mppi 路径规划：
 sudo apt install ros-humble-nav2-mppi-controller