YUJIN ROBOT

YUJIN AMS

YUJIN 3D LiDAR

YRL3V2 Series

Driver Package Operations Guide

Revision: 1.0
Date: 2022/04

YUJIN ROBOT

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Change History

The following table contains version information for this document and a history of significant changes.

Version	Date of Writing	Changes
V1.0	Jan 10, 2022	Draft

Table of Contents

1. Introduction

Yujin Robot provides a driver package for YUJIN LiDAR.

You can install and use the driver package in Ubuntu OS.

- Ubuntu is an open source OS.
- How to enter commands in Ubuntu OS: Run “**ctrl +alt + t**” on the desktop to enable the Terminal window and enter the desired command.

Note: This document is prepared for users of Ubuntu 20.04.

2. Installing the driver package

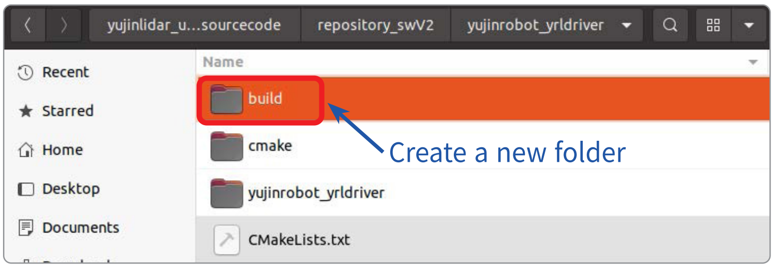
The driver package folder “yujinrobot_yrldriver” contains the following items:

- build (Create a new “build” folder.)
- cmake
- yujinrobot_yrldriver
- CMakeLists.txt

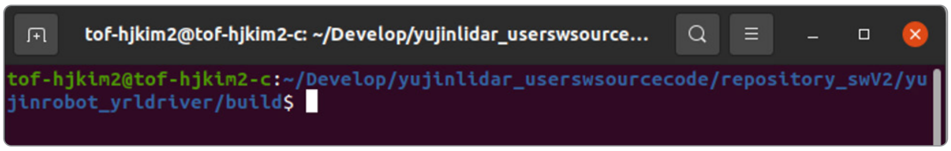
2.1 Creating a build folder

Create a new folder named “build”.

1. Create a new “build” folder under the “yujinrobot_yrldriver” folder.



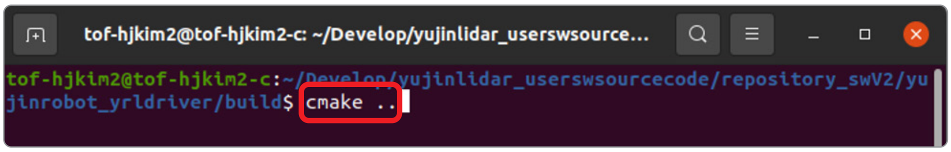
2. Launch the Terminal window in the newly created “build” folder.


tof-hjkim2@tof-hjkim2-c: ~/Develop/yujinlidar_userswsource...

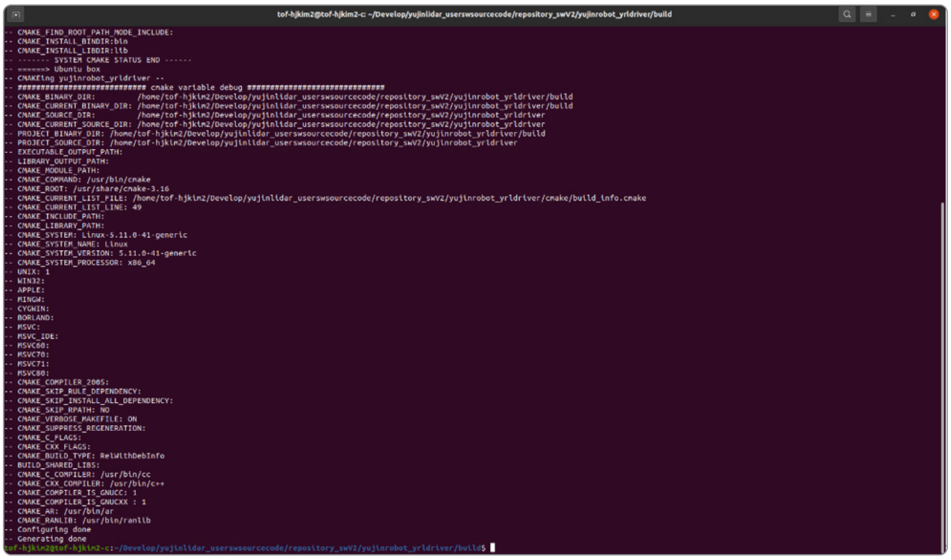
```
tof-hjkim2@tof-hjkim2-c:~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build$ 
```

3. Enter the command to set up the compile preferences.

- Command: cmake …

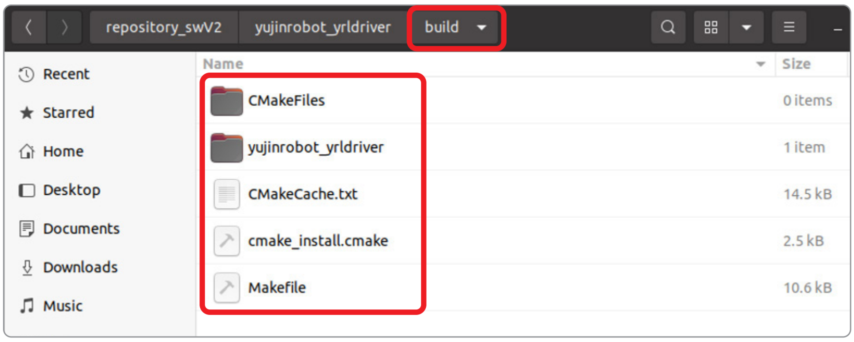

tof-hjkim2@tof-hjkim2-c: ~/Develop/yujinlidar_userswsource...

```
tof-hjkim2@tof-hjkim2-c:~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build$ cmake ..
```



```
tof-hjkim2@tof-hjkim2-c: ~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build
-- CMAKE_FIND_ROOT_PATH_MODE_INCLUDE:
-- CMAKE_INSTALL_BINDIR:bin
-- CMAKE_INSTALL_LIBDIR:lib
-- ------- SYSTEM CMAKE STATUS END ------
-- ======> Ubuntu box
-- CMAKEing yujinrobot_yrldriver --
-- ############################ cmake variable debug ##############################
-- CMAKE_BINARY_DIR:         /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build
-- CMAKE_CURRENT_BINARY_DIR: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build
-- CMAKE_SOURCE_DIR:         /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver
-- CMAKE_CURRENT_SOURCE_DIR: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver
-- PROJECT_BINARY_DIR: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build
-- PROJECT_SOURCE_DIR: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver
-- EXECUTABLE_OUTPUT_PATH:
-- LIBRARY_OUTPUT_PATH:
-- CMAKE_MODULE_PATH:
-- CMAKE_COMMAND: /usr/bin/cmake
-- CMAKE_ROOT: /usr/share/cmake-3.16
-- CMAKE_CURRENT_LIST_FILE: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/cmake/build_info.cmake
-- CMAKE_CURRENT_LIST_LINE: 49
-- CMAKE_INCLUDE_PATH:
-- CMAKE_LIBRARY_PATH:
-- CMAKE_SYSTEM: Linux-5.11.0-41-generic
-- CMAKE_SYSTEM_NAME: Linux
-- CMAKE_SYSTEM_VERSION: 5.11.0-41-generic
-- CMAKE_SYSTEM_PROCESSOR: x86_64
-- UNIX: 1
-- WIN32:
-- APPLE:
-- MINGW:
-- CYGWIN:
-- BORLAND:
-- MSVC:
-- MSVC_IDE:
-- MSVC60:
-- MSVC70:
-- MSVC71:
-- MSVC80:
-- CMAKE_COMPILER_2005:
-- CMAKE_SKIP_RULE_DEPENDENCY:
-- CMAKE_SKIP_INSTALL_ALL_DEPENDENCY:
-- CMAKE_SKIP_RPATH: NO
-- CMAKE_VERBOSE_MAKEFILE: ON
-- CMAKE_SUPPRESS_REGENERATION:
-- CMAKE_C_FLAGS:
-- CMAKE_CXX_FLAGS:
-- CMAKE_BUILD_TYPE: RelWithDebInfo
-- BUILD_SHARED_LIBS:
-- CMAKE_C_COMPILER: /usr/bin/cc
-- CMAKE_CXX_COMPILER: /usr/bin/c++
-- CMAKE_COMPILER_IS_GNUCC: 1
-- CMAKE_COMPILER_IS_GNUCXX : 1
-- CMAKE_AR: /usr/bin/ar
-- CMAKE_RANLIB: /usr/bin/ranlib
-- Configuring done
-- Generating done
tof-hjkim2@tof-hjkim2-c:~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build$
```

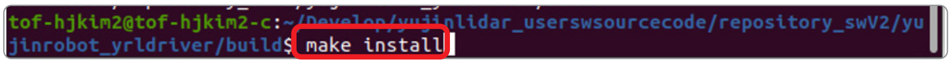
4. Check if all of the files below are created in the “build” folder.



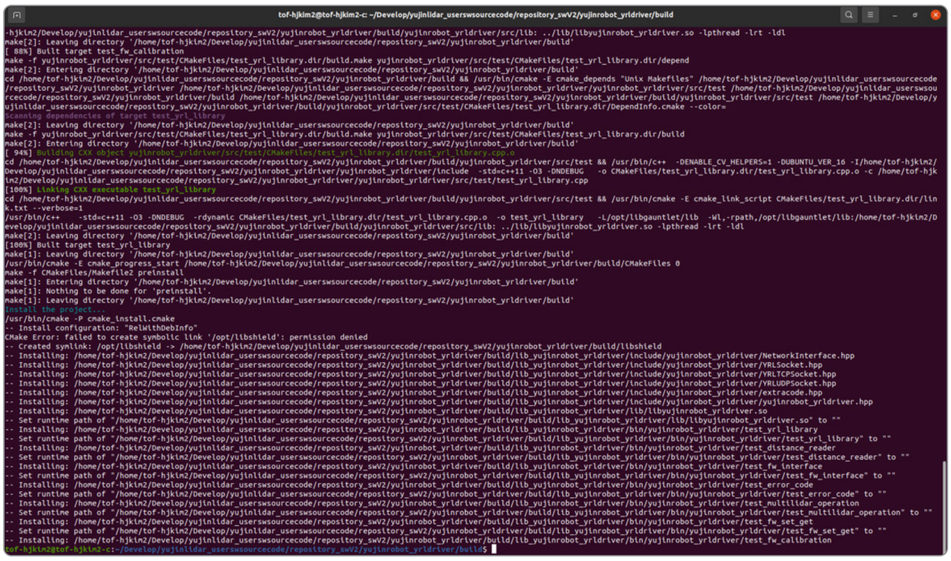
Name	Size
CMakeFiles	0 items
yujinrobot_yrldriver	1 item
CMakeCache.txt	14.5 kB
cmake_install.cmake	2.5 kB
Makefile	10.6 kB

5. Enter the command to compile the source code.

- Command: make install

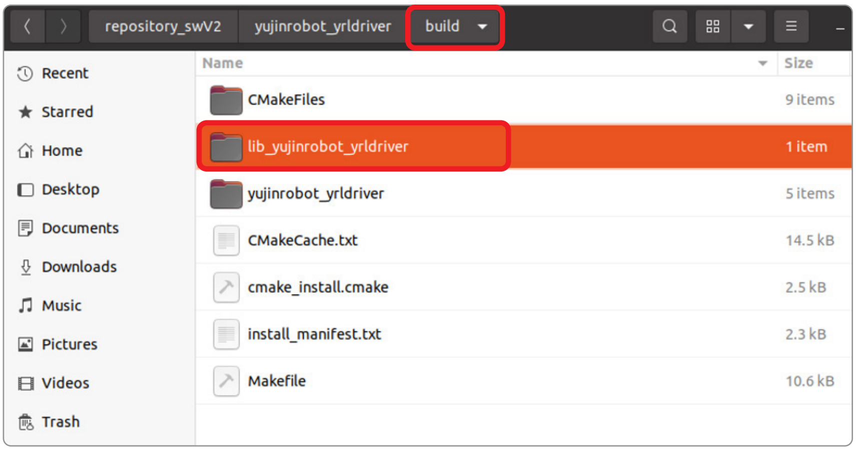


```
tof-hjkim2@tof-hjkim2-c:~/Develop/yujinlidar_userswsourcecode/repository_swV2/yu
jinrobot_yrldriver/build$ make install
```



```
tof-hjkim2@tof-hjkim2-c: ~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build
-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/yujinrobot_yrldriver/src/lib: ../lib/libyujinrobot_yrldriver.so -lpthread -lrt -ldl
make[2]: Leaving directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
[ 88%] Built target test_fw_calibration
make -f yujinrobot_yrldriver/src/test/CMakeFiles/test_yrl_library.dir/build.make yujinrobot_yrldriver/src/test/CMakeFiles/test_yrl_library.dir/depend
make[2]: Entering directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
cd /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build && /usr/bin/cmake -E cmake_depends "Unix Makefiles" /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode
/repository_swV2/yujinrobot_yrldriver /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/yujinrobot_yrldriver/src/test /home/tof-hjkim2/Develop/yujinlidar_userswsou
rcecode/repository_swV2/yujinrobot_yrldriver/build /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/yujinrobot_yrldriver/src/test /home/tof-hjkim2/Develop/y
ujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/yujinrobot_yrldriver/src/test/CMakeFiles/test_yrl_library.dir/DependInfo.cmake --color=
Scanning dependencies of target test_yrl_library
make[2]: Leaving directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
make -f yujinrobot_yrldriver/src/test/CMakeFiles/test_yrl_library.dir/build.make yujinrobot_yrldriver/src/test/CMakeFiles/test_yrl_library.dir/build
make[2]: Entering directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
[ 94%] Building CXX object yujinrobot_yrldriver/src/test/CMakeFiles/test_yrl_library.dir/test_yrl_library.cpp.o
cd /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/yujinrobot_yrldriver/src/test && /usr/bin/c++  -DENABLE_CV_HELPERS=1 -DUBUNTU_VER_16 -I/home/tof-hjkim2/
Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/yujinrobot_yrldriver/include  -std=c++11 -O3 -DNDEBUG   -o CMakeFiles/test_yrl_library.dir/test_yrl_library.cpp.o -c /home/tof-hjk
im2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/yujinrobot_yrldriver/src/test/test_yrl_library.cpp
[100%] Linking CXX executable test_yrl_library
cd /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/yujinrobot_yrldriver/src/test && /usr/bin/cmake -E cmake_link_script CMakeFiles/test_yrl_library.dir/lin
k.txt --verbose=1
/usr/bin/c++    -std=c++11 -O3 -DNDEBUG  -rdynamic CMakeFiles/test_yrl_library.dir/test_yrl_library.cpp.o  -o test_yrl_library   -L/opt/libgauntlet/lib  -Wl,-rpath,/opt/libgauntlet/lib:/home/tof-hjkim2/D
evelop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/yujinrobot_yrldriver/src/lib: ../lib/libyujinrobot_yrldriver.so -lpthread -lrt -ldl
make[2]: Leaving directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
[100%] Built target test_yrl_library
make[1]: Leaving directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
/usr/bin/cmake -E cmake_progress_start /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/CMakeFiles 0
make -f CMakeFiles/Makefile2 preinstall
make[1]: Entering directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
make[1]: Nothing to be done for 'preinstall'.
make[1]: Leaving directory '/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build'
Install the project...
/usr/bin/cmake -P cmake_install.cmake
-- Install configuration: "RelWithDebInfo"
CMake Error: failed to create symbolic link '/opt/libshield': permission denied
-- Created symlink: /opt/libshield -> /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/libshield
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/include/yujinrobot_yrldriver/NetworkInterface.hpp
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/include/yujinrobot_yrldriver/YRLSocket.hpp
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/include/yujinrobot_yrldriver/YRLTCPSocket.hpp
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/include/yujinrobot_yrldriver/YRLUDPSocket.hpp
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/include/yujinrobot_yrldriver/extracode.hpp
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/include/yujinrobot_yrldriver/yujinrobot_yrldriver.hpp
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/lib/libyujinrobot_yrldriver.so
-- Set runtime path of "/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/lib/libyujinrobot_yrldriver.so" to ""
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_yrl_library
-- Set runtime path of "/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_yrl_library" to ""
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_distance_reader
-- Set runtime path of "/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_distance_reader" to ""
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_fw_interface
-- Set runtime path of "/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_fw_interface" to ""
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_error_code
-- Set runtime path of "/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_error_code" to ""
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_multilidar_operation
-- Set runtime path of "/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_multilidar_operation" to ""
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_fw_set_get
-- Set runtime path of "/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_fw_set_get" to ""
-- Installing: /home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver/test_fw_calibration
tof-hjkim2@tof-hjkim2-c:~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build$
```

6. Check if an additional file has been created in the “build” folder as shown below. The ”lib_yujinrobot_yrldriver” folder contains a test execution file and a driver library file.



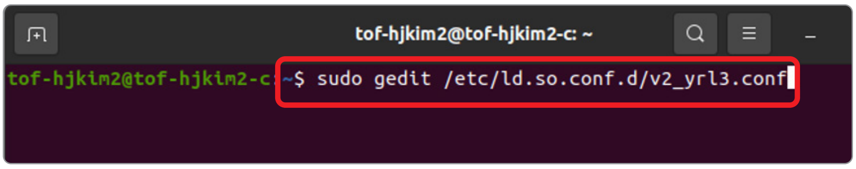
Name	Size
CMakeFiles	9 items
lib_yujinrobot_yrldriver	1 item
yujinrobot_yrldriver	5 items
CMakeCache.txt	14.5 kB
cmake_install.cmake	2.5 kB
install_manifest.txt	2.3 kB
Makefile	10.6 kB

3. Running the driver package

3.1 Setting up the library path

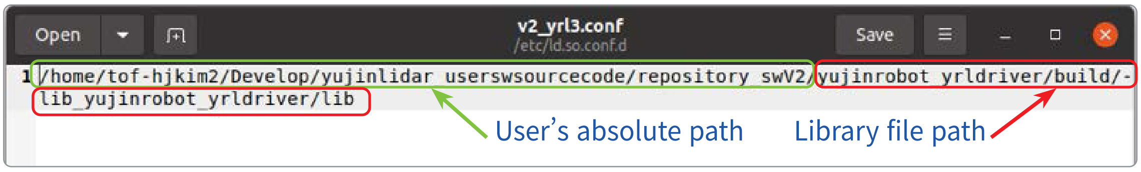
1. Launch the Terminal window and create a configuration file to set up the library path. Enter the command below.

- Command: ~$ sudo gedit /etc/ld.so.conf.d/**[File name]**.conf
    - **[File name]**: File name set by the user



```
tof-hjkim2@tof-hjkim2-c:~$ sudo gedit /etc/ld.so.conf.d/v2_yrl3.conf
```

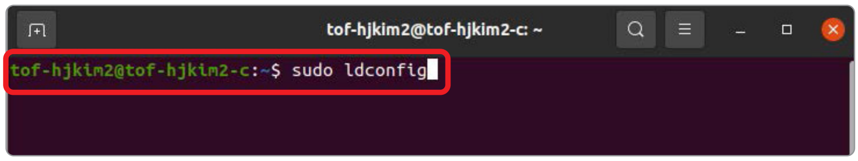
2. In the file created, enter the **[User’s absolute path]** and **[Library file path]** as shown below.
    - **[User’s absolute path]**: File path set by the user
    - **[Library file path]**: yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/lib



```
/home/tof-hjkim2/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/-
lib_yujinrobot_yrldriver/lib
```

3. Configure the shared library cache again. Enter the command below.

- Command: sudo ldconfig



```
tof-hjkim2@tof-hjkim2-c:~$ sudo ldconfig
```

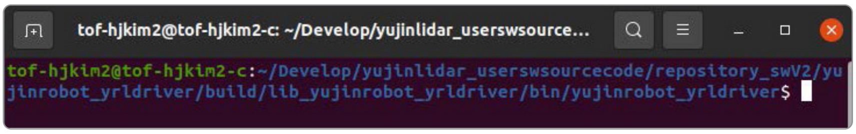
3.2 Running the test code

- Provided test code:
  - test_yrl_library
  - test_IP_change
  - test_mode_change
  - test_recover_network

- test_yrl_library run command: [executable file name] [IP address]
  - example) ./test_yrl_library 192.168.1.250
  - test_IP_change run command: [executable file name] [current IP address] [new IP address]
  - example) ./test_IP_change 192.168.1.250 192.168.11
  - test_mode_change run command: [executable file name] [IP address] [mode]
  - example) ./test_mode_change 192.168.1.250 1
  - test_recover_network run command: [executable file name] [IP address]
  - example) ./test_recover_network 192.168.1.250

1. Go to the folder that contains the "test code execution file".

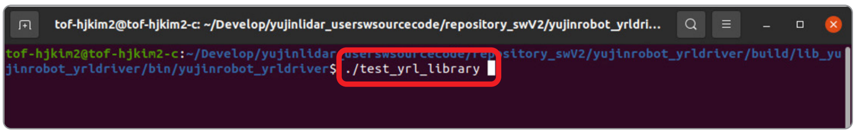
- yujinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver


tof-hjkim2@tof-hjkim2-c: ~/Develop/yujinlidar_userswsource...

```
tof-hjkim2@tof-hjkim2-c:~/Develop/yujinlidar_userswsourcecode/repository_swV2/yu
jinrobot_yrldriver/build/lib_yujinrobot_yrldriver/bin/yujinrobot_yrldriver$ 
```

2. Launch the Terminal window and enter the command to run the test code.

- test_yrl_library


tof-hjkim2@tof-hjkim2-c: ~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldri...

```
tof-hjkim2@tof-hjkim2-c:~/Develop/yujinlidar_userswsourcecode/repository_swV2/yujinrobot_yrldriver/build/lib_yu
jinrobot_yrldriver/bin/yujinrobot_yrldriver$ ./test_yrl_library 
```

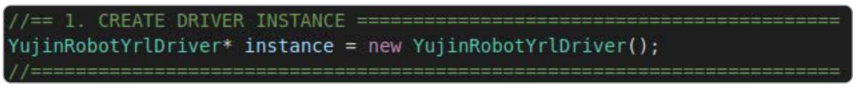
4. Using the test code

Yujin Robot provides a sample test code “test_yrl_library.cpp” for using the driver.

- File path: yujinrobot_yrldriver/yujinrobot_yrldriver/src/test/ test_yrl_library.cpp

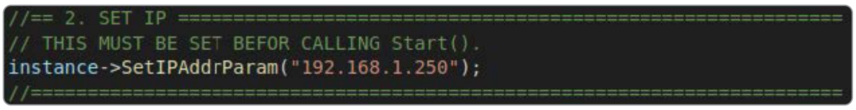
The main () in the “test_yrl_library.cpp” provides the function call order as an annotation.

1. Create the driver object.



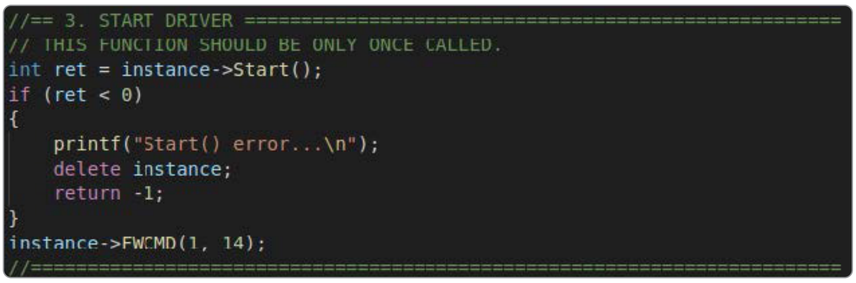
```
//== 1. CREATE DRIVER INSTANCE ==========================================
YujinRobotYrlDriver* instance = new YujinRobotYrlDriver();
//=====================================================================
```

2. Enter LiDAR’s IP address.



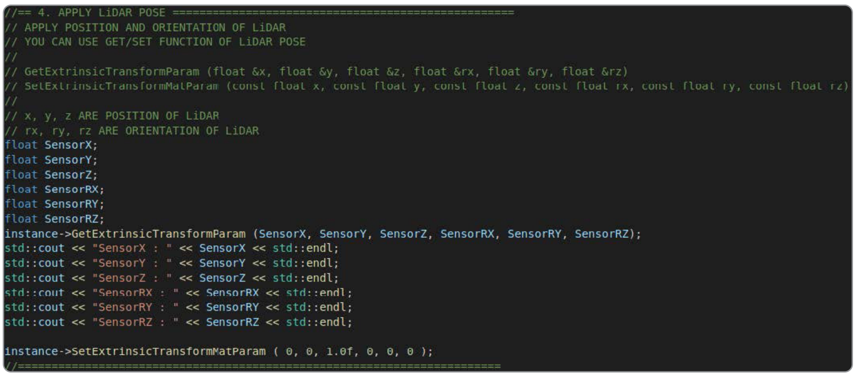
```
//== 2. SET IP ==========================================================
// THIS MUST BE SET BEFOR CALLING Start().
instance->SetIPAddrParam("192.168.1.250");
//=====================================================================
```

3. Establish TCP connection with LiDAR using the IP address.



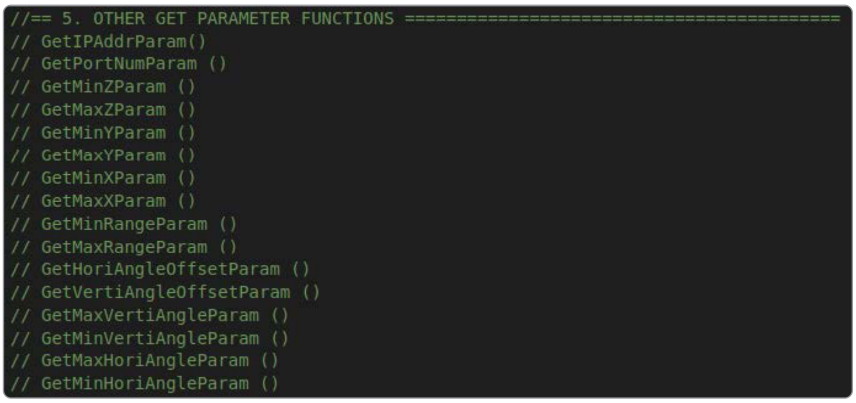
```
//== 3. START DRIVER ====================================================
// THIS FUNCTION SHOULD BE ONLY ONCE CALLED.
int ret = instance->Start();
if (ret < 0)
{
    printf("Start() error...\n");
    delete instance;
    return -1;
}
instance->FWCMD(1, 14);
//=====================================================================
```

4. You can read and modify the processing parameters for data input/output.

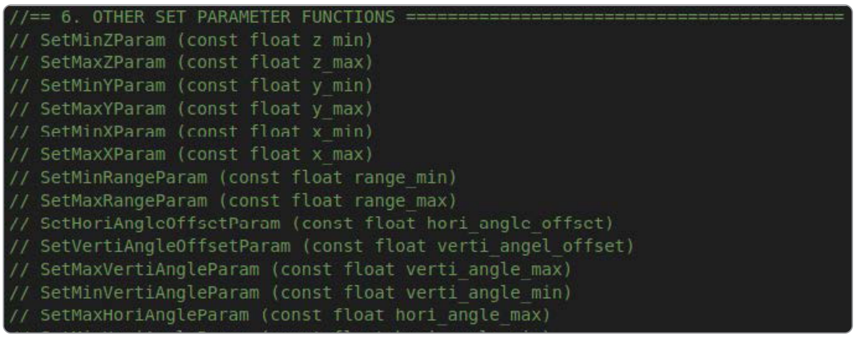


```
//== 4. APPLY LiDAR POSE ================================================
// APPLY POSITION AND ORIENTATION OF LiDAR
// YOU CAN USE GET/SET FUNCTION OF LiDAR POSE
//
// GetExtrinsicTransformParam (float &x, float &y, float &z, float &rx, float &ry, float &rz)
// SetExtrinsicTransformMatParam (const float x, const float y, const float z, const float rx, const float ry, const float rz)
//
// x, y, z ARE POSITION OF LiDAR
// rx, ry, rz ARE ORIENTATION OF LiDAR
float SensorX;
float SensorY;
float SensorZ;
float SensorRX;
float SensorRY;
float SensorRZ;
instance->GetExtrinsicTransformParam (SensorX, SensorY, SensorZ, SensorRX, SensorRY, SensorRZ);
std::cout << "SensorX : " << SensorX << std::endl;
std::cout << "SensorY : " << SensorY << std::endl;
std::cout << "SensorZ : " << SensorZ << std::endl;
std::cout << "SensorRX : " << SensorRX << std::endl;
std::cout << "SensorRY : " << SensorRY << std::endl;
std::cout << "SensorRZ : " << SensorRZ << std::endl;

instance->SetExtrinsicTransformMatParam ( 0, 0, 1.0f, 0, 0, 0 );
//=====================================================================
```



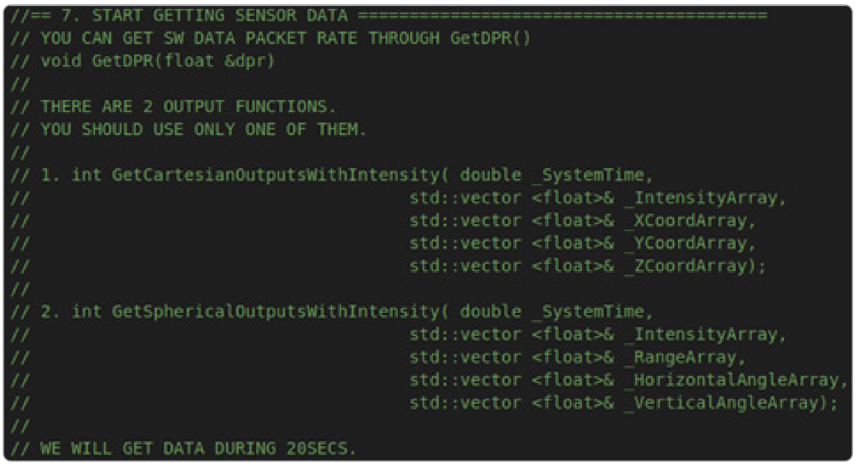
```
//== 5. OTHER GET PARAMETER FUNCTIONS ===================================
// GetIPAddrParam()
// GetPortNumParam ()
// GetMinZParam ()
// GetMaxZParam ()
// GetMinYParam ()
// GetMaxYParam ()
// GetMinXParam ()
// GetMaxXParam ()
// GetMinRangeParam ()
// GetMaxRangeParam ()
// GetHoriAngleOffsetParam ()
// GetVertiAngleOffsetParam ()
// GetMaxVertiAngleParam ()
// GetMinVertiAngleParam ()
// GetMaxHoriAngleParam ()
// GetMinHoriAngleParam ()
```



```
//== 6. OTHER SET PARAMETER FUNCTIONS ==========================================
// SetMinZParam (const float z_min)
// SetMaxZParam (const float z_max)
// SetMinYParam (const float y_min)
// SetMaxYParam (const float y_max)
// SetMinXParam (const float x_min)
// SetMaxXParam (const float x_max)
// SetMinRangeParam (const float range_min)
// SetMaxRangeParam (const float range_max)
// SetHoriAngleOffsetParam (const float hori_angle_offset)
// SetVertiAngleOffsetParam (const float verti_angel_offset)
// SetMaxVertiAngleParam (const float verti_angle_max)
// SetMinVertiAngleParam (const float verti_angle_min)
// SetMaxHoriAngleParam (const float hori_angle_max)
```

5. Functions that output sensor values are specified as annotations. One of the following two functions will be used:

- void GetCartesianOutputsWithIntensity(): Get the intensity and coordinates of the point cloud.
- void GetSphericalOutputsWithIntensity(): Get the intensity, range, horizontal angle, and vertical angle of the point cloud.

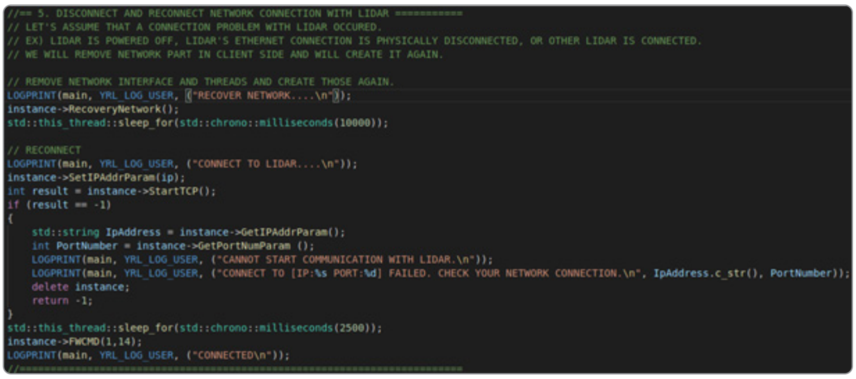


```
//== 7. START GETTING SENSOR DATA ========================================
// YOU CAN GET SW DATA PACKET RATE THROUGH GetDPR()
// void GetDPR(float &dpr)
//
// THERE ARE 2 OUTPUT FUNCTIONS.
// YOU SHOULD USE ONLY ONE OF THEM.
//
// 1. int GetCartesianOutputsWithIntensity( double _SystemTime,
//                                        std::vector <float>& _IntensityArray,
//                                        std::vector <float>& _XCoordArray,
//                                        std::vector <float>& _YCoordArray,
//                                        std::vector <float>& _ZCoordArray);
//
// 2. int GetSphericalOutputsWithIntensity( double _SystemTime,
//                                        std::vector <float>& _IntensityArray,
//                                        std::vector <float>& _RangeArray,
//                                        std::vector <float>& _HorizontalAngleArray,
//                                        std::vector <float>& _VerticalAngleArray);
//
// WE WILL GET DATA DURING 20SECS.
```

6. While running the code, the Network Recovery function is provided in the following cases:

- When LiDAR is turned off
- When LiDAR is disconnected from Ethernet
- When connecting another LiDAR

You can use the Recovery Network function of the sample test code “test_recover_network.cpp”.



```
//== 5. DISCONNECT AND RECONNECT NETWORK CONNECTION WITH LIDAR ==========
// LET'S ASSUME THAT A CONNECTION PROBLEM WITH LIDAR OCCURED.
// EX) LIDAR IS POWERED OFF, LIDAR'S ETHERNET CONNECTION IS PHYSICALLY DISCONNECTED, OR OTHER LIDAR IS CONNECTED.
// WE WILL REMOVE NETWORK PART IN CLIENT SIDE AND WILL CREATE IT AGAIN.

// REMOVE NETWORK INTERFACE AND THREADS AND CREATE THOSE AGAIN.
LOGPRINT(main, YRL_LOG_USER, ("RECOVER NETWORK....\n"));
instance->RecoveryNetwork();
std::this_thread::sleep_for(std::chrono::milliseconds(10000));

// RECONNECT
LOGPRINT(main, YRL_LOG_USER, ("CONNECT TO LIDAR....\n"));
instance->SetIPAddrParam(ip);
int result = instance->StartTCP();
if (result == -1)
{
    std::string IpAddress = instance->GetIPAddrParam();
    int PortNumber = instance->GetPortNumParam ();
    LOGPRINT(main, YRL_LOG_USER, ("CANNOT START COMMUNICATION WITH LIDAR.\n"));
    LOGPRINT(main, YRL_LOG_USER, ("CONNECT TO [IP:%s PORT:%d] FAILED. CHECK YOUR NETWORK CONNECTION.\n", IpAddress.c_str(), PortNumber));
    delete instance;
    return -1;
}
std::this_thread::sleep_for(std::chrono::milliseconds(2500));
instance->FWCMD(1,14);
LOGPRINT(main, YRL_LOG_USER, ("CONNECTED\n"));
//=================================================================
```

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