

AAE3004 - DYNAMICAL SYSTEMS AND CONTROL

ROS AUTONOMOUS CAR TUTORIAL

MANUAL FOR ACCESSING STM32 SOURCE CODE

SEM I 2022/23

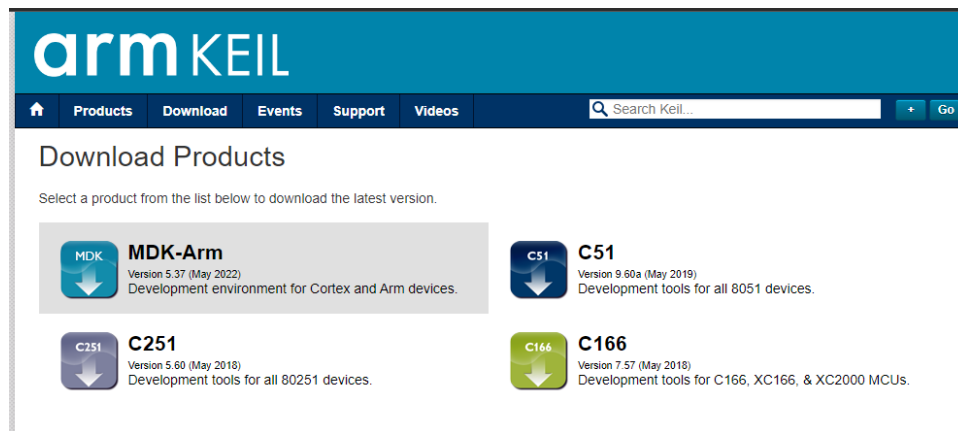
Drafted by: VICENZO Sergio

Preface

This document will introduce you how to download and install the µvision IDE in order to alter the PID controller of the ROS car's STM32 source code.

Downloading and Installing µvision IDE

1. Open the following link <https://www.keil.com/download/product/>



and choose “MDK-Arm”.

2. Fill in your personal particulars

MDK-ARM
MDK-ARM Version 5.37
Version 5.37
Complete the following form to download the Keil software development tools.

Enter Your Contact Information Below

First Name:

Last Name:

E-mail:

Company:

Job Title:

Country/Region:

State/Province:

Phone:

☐ Send me e-mail when there is a new update.
NOTICE:
If you select this check box, you **will** receive an e-mail message from Keil whenever a new update is available. If you don't wish to receive an e-mail notification, don't check this box.

Which device are you using?
(eg, STM32)

Arm will process your information in accordance with the Evaluation section of our [Privacy Policy](#).

☐ Please keep me updated on products, services and other relevant offerings from Arm. You can change your mind and unsubscribe at any time.

3. Download and install the µvision IDE

Home / Product Downloads

MDK-ARM

MDK-ARM Version 5.37
Version 5.37

- Review the [hardware requirements](#) before installing this software.
- Note the [limitations of the evaluation tools](#).
- [Further installation instructions for MDK5](#)

(MD5:9a3e824a57eb370555826d53f2f6056d)

To install the MDK-ARM Software...

- Right-click on **MDK537.EXE** and save it to your computer.
- PDF files may be opened with Acrobat Reader.
- ZIP files may be opened with PKZIP or WINZIP.

MDK537.EXE (876,270K)
Tuesday, May 3, 2022

- If you are evaluating the tools, be sure to [request a quote](#) for the full version of the tools.

4. Since the STM32 source code we are dealing with is old, the IDE's compilers need to be edited before we can start. Open the following link <https://blog.csdn.net/mowwwwcom/article/details/124790542>

uses ARM-Compiler 'Default Compiler Version 5' which is not available. MDK5.37安装ARM_Compiler_5

原创 呈叙墨客 已于 2022-09-09 09:21:43 修改 7252 收藏 30

分类专栏: +3 嵌入式开发 文章标签: arm arm开发 嵌入式硬件

+3 嵌入式开发 专栏收录该内容 0 订阅 2 篇文章 订阅专栏

MDK5.37安装ARM_Compiler_5

最后一个AC5编译器，从MDK5.37开始，不再默认安装，需要独立安装

ARMCompiler_506_Windows_x86_b960.zip (80.94MB)

否则使用AC5编译代码报错如下：

```
Build Output
Build started: Project: Project
*** Target 'STM3210C_EVAL' uses ARM Compiler 'Default Compiler Version 5' which is not available.
*** Please review the installed ARM Compiler Versions:
'Manage Project Items - Folders/Extensions' to manage ARM Compiler Versions.
'Options for Target - Target' to select an ARM Compiler Version for the target.
*** Build aborted.
Build Time Elapsed: 00:00:00
```

CSDN @呈叙墨客

```
1 Build started: Project: Project
2 *** Target 'STM3210C_EVAL' uses ARM Compiler 'Default Compiler Version 5' which is not available.
3 *** Please review the installed ARM Compiler Versions:
4 'Manage Project Items - Folders/Extensions' to manage ARM Compiler Versions.
5 'Options for Target - Target' to select an ARM Compiler Version for the target.
6 *** Build aborted.
7 Build Time Elapsed: 00:00:00
```

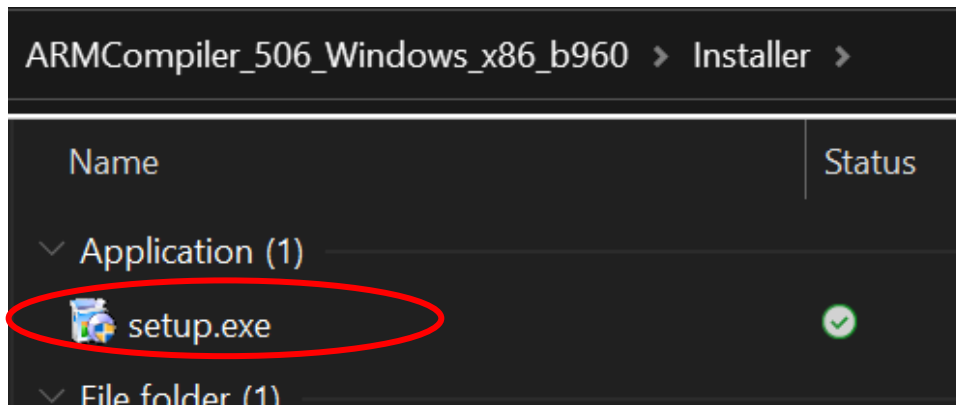
解决办法

1、AC5安装时配置为路径

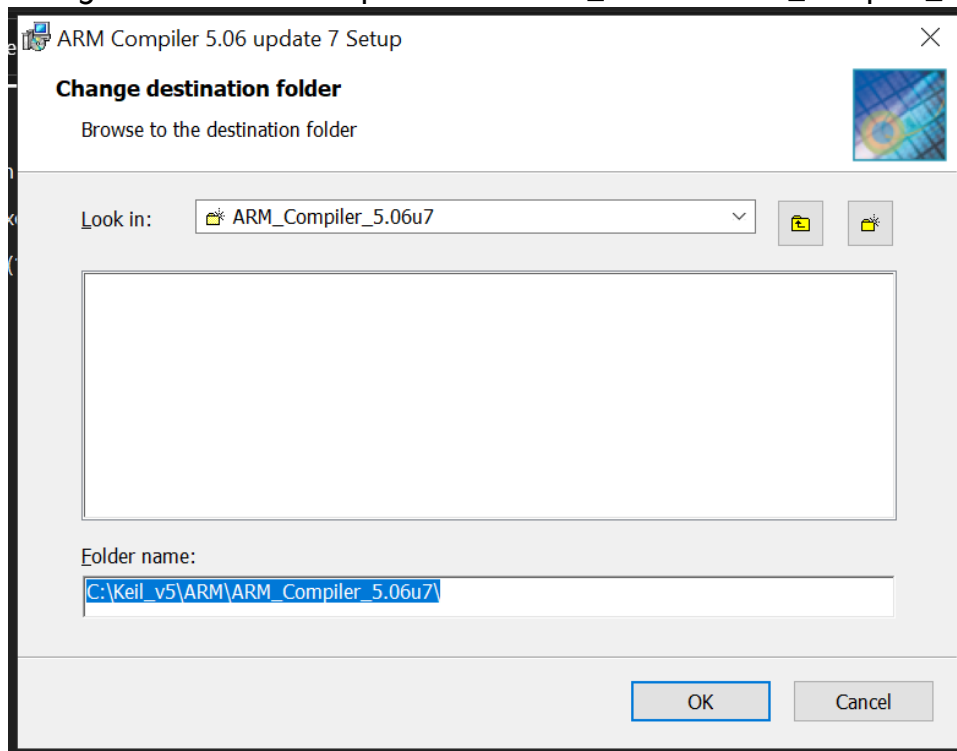
C:\Keil_v5\ARM\ARM_Compiler_5.06u7

download the zip file.

5. Open setup.exe



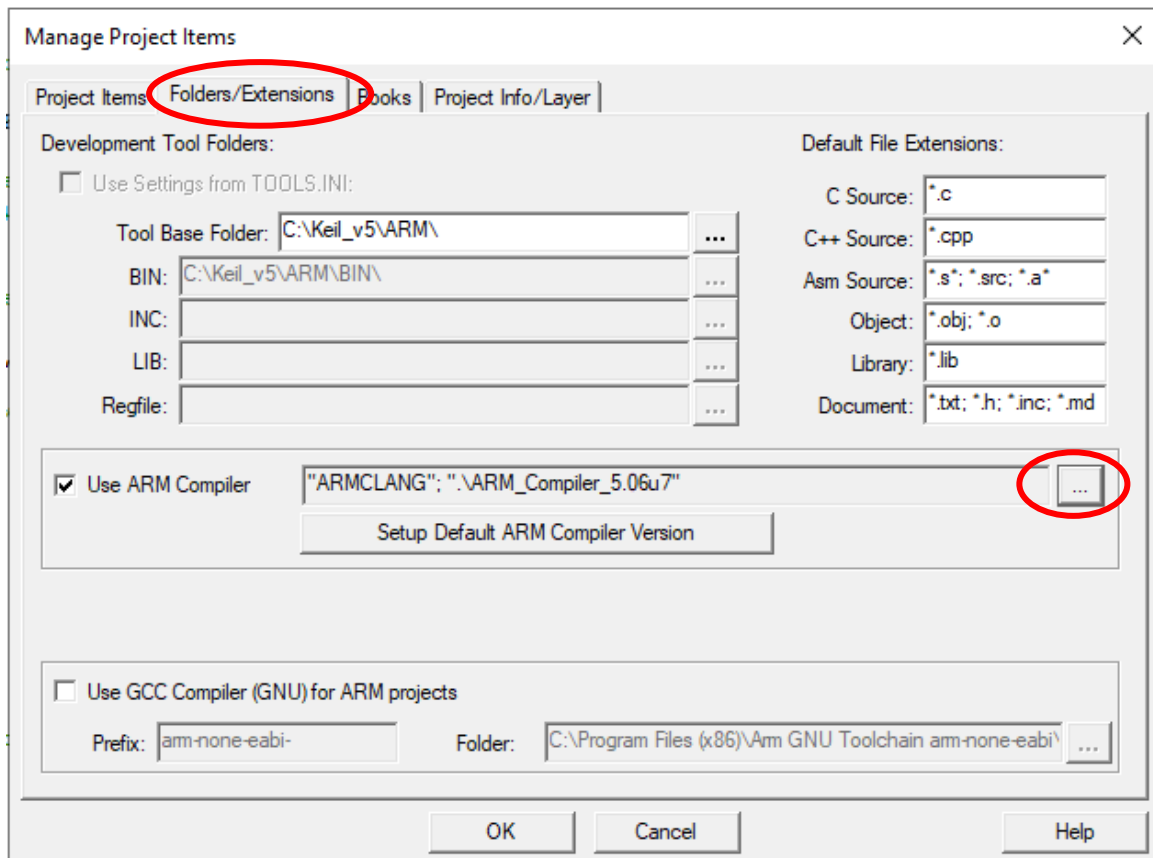
6. Configure the installation path is to C:\Keil_v5\ARM\ARM_Compiler_5.06u7\



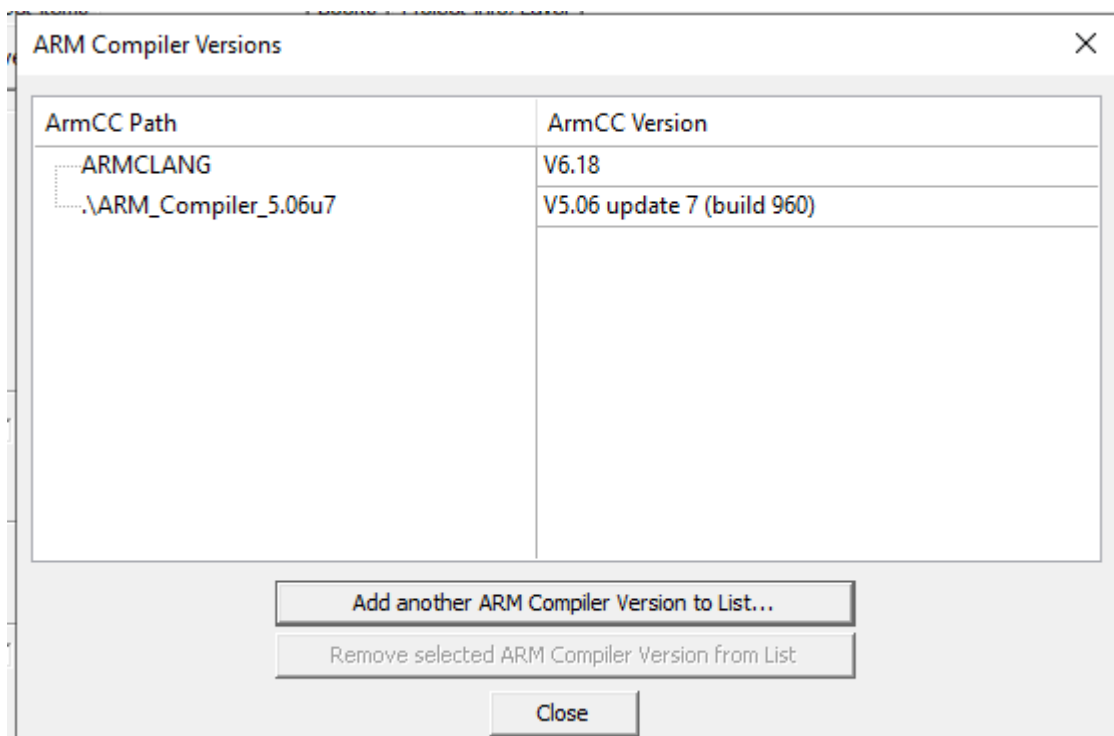
7. Open the µvision IDE and go to Project Items



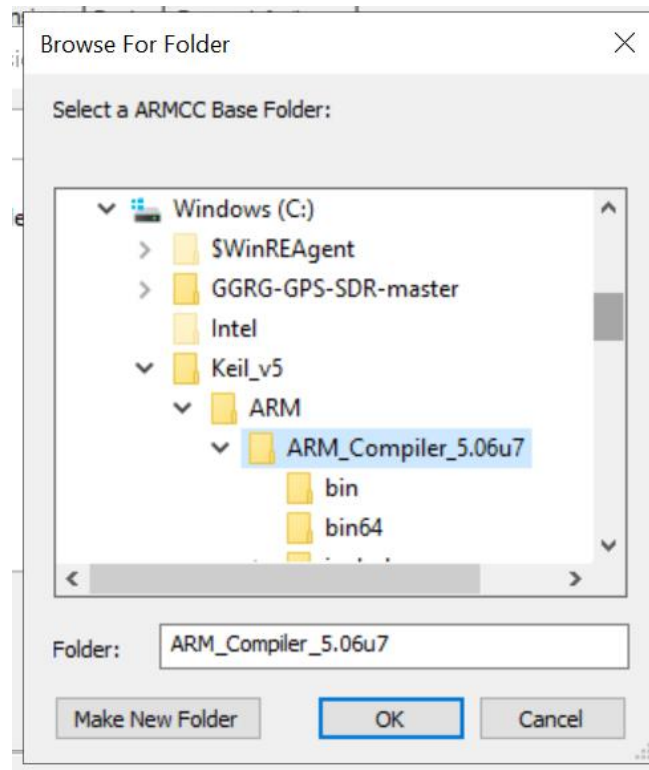
8. Go to Folders/Extensions and click ...



9. Go to "Add another ARM Compiler Version to List"



10. Select the ARM_Compiler_5.06u7 folder and click ok



11. Next, since the STM32 source code is large, we need to apply for a Professional version of the IDE. We can apply for a 30-days free trial by going to License Management or clicking the following link

<https://www.keil.com/MDKEvaluationRequest/>

You will receive by email an LIC which you must enter in License Management

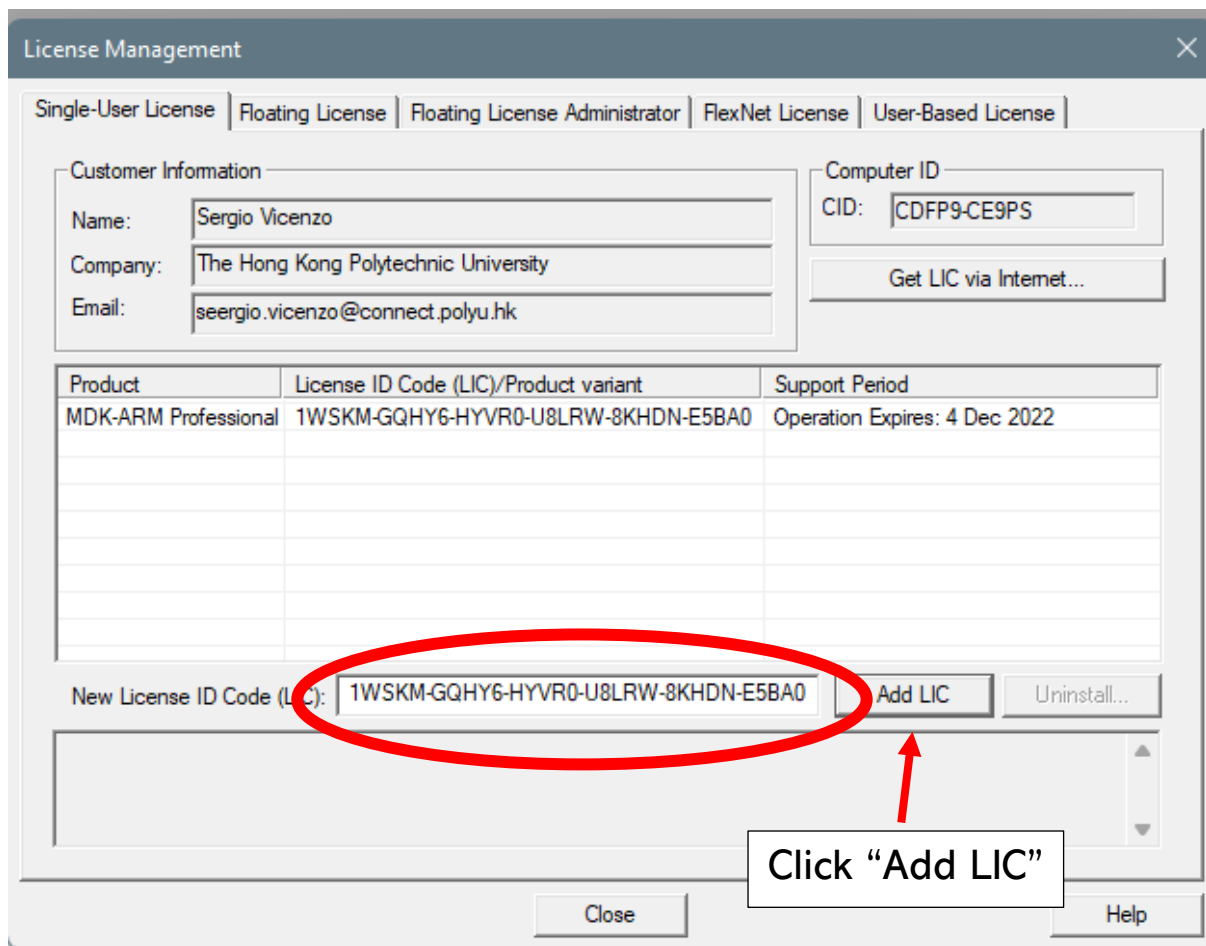
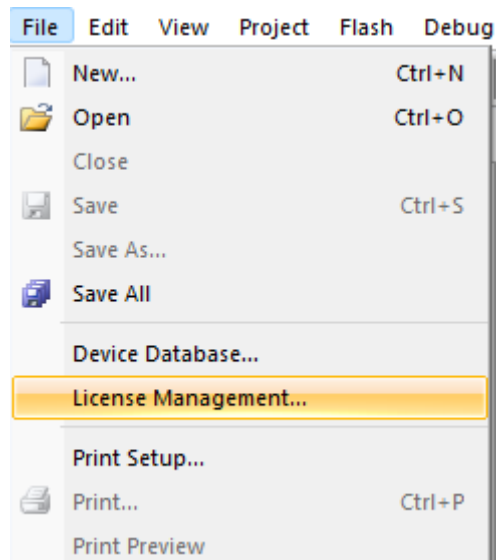
Thanks for evaluating Arm Keil MDK! You requested LIC is as follows:
1WSKM-GQHY6-HYVR0-U8LRW-8KHDN-E5BA0
To add this license key to your installation of MDK, please follow the procedure as outlined here: www.keil.com/support/man/docs/license/license_sul_install.htm (you can skip steps 4. and 5.)

If you encounter any problems, please contact our support via <http://www2.keil.com/support/silver>.

Getting started with MDK is easy: download our Getting Started Guide from www.keil.com/gsg.

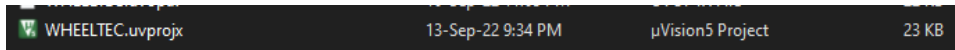
After the evaluation, you may get in contact with one of our distributors (www.keil.com/distis) or purchase the tool online: <https://store.developer.arm.com/store/embedded-iot-software-tools/keil-mdk>.

Best wishes,
Arm Keil MDK team



STM32 Source Code

1. The source code for the STM32 is named STM32 source code_F407VET6_2021.09.27.zip and can be downloaded from GitHub.
2. After download, unzip the file. The project file can be found in the USER folder under the name WHEELTEC.uvprojx

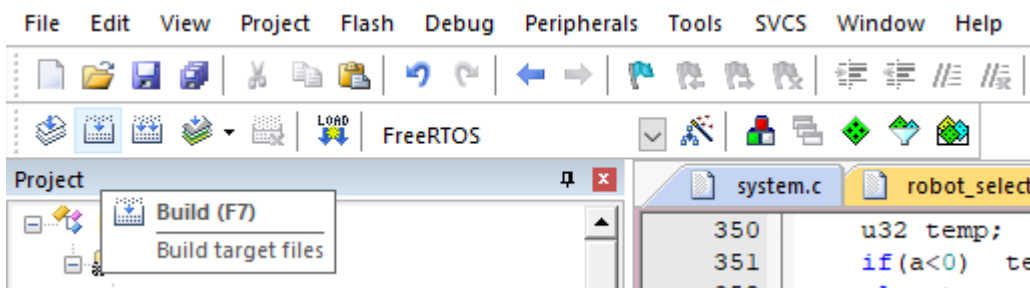


3. Open the project file with the µvision IDE. From here, you are free to alter the STM32's source code, especially the car's PID controller. For example, the motor's PID controller can be found in balance.c

You are strongly encouraged to explore and modify the PID controller. More marks will be given for those who shows effort in doing so.


































```
Function: Incremental PI controller
Input   : Encoder measured value (actual speed), target speed
Output  : Motor PWM
According to the incremental discrete PID formula
pwm+=Kp[e(k)-e(k-1)]+Ki*e(k)+Kd[e(k)-2e(k-1)+e(k-2)]
e(k) represents the current deviation
e(k-1) is the last deviation and so on
PWM stands for incremental output
In our speed control closed loop system, only PI control is used
pwm+=Kp[e(k)-e(k-1)]+Ki*e(k)
```

4. After editing the code, click on Build to create a .hex file



A .hex file will; be generated in OBJ folder inside of the STM32 source code_F407VET6_2021.09.27 folder.

Name

-  stm32f4xx_tim.crf
-  stm32f4xx_tim.d
-  stm32f4xx_tim.o
-  stm32f4xx_usart.crf
-  stm32f4xx_usart.d
-  stm32f4xx_usart.o
-  sys.crf
-  sys.d
-  sys.o
-  system.crf
-  system.d
-  system.o
-  system_stm32f4xx.crf
-  system_stm32f4xx.d
-  system_stm32f4xx.o
-  tasks.crf
-  tasks.d
-  tasks.o
-  timer.crf
-  timer.d
-  timer.o
-  timers.crf
-  timers.d
-  timers.o
-  usart.crf
-  usart.d
-  usart.o
-  usartx.crf
-  usartx.d
-  usartx.o
-  WHEELTEC.axf
-  WHEELTEC.build_log.htm
-  **WHEELTEC.hex**

A tutorial video on how to download the .hex file into the STM32 can be accessed in GitHub, under the folder “Download the program via USB”. The app FlyMcu can be downloaded from GitHub.

To perfectly run this car will take time and practice with trial and error. If you have any questions or encounter any difficulties, please do not hesitate to either contact Dr. Bing Xu at pbing.xu@polyu.edu.hk, Mr. Liu Jian at jian1.liu@polyu.edu.hk, or Mr. Sergio Vincenzo at sergio.vicenzo@connect.polyu.hk.

Thank you and hope you enjoy the project!