AAE3004 - DYNAMICAL SYSTEMS AND CONTROL

ROS AUTONOMOUS CAR TUTORIAL

MANUAL FOR ACCESSING STM32 SOURCE CODE

SEM I 2022/23

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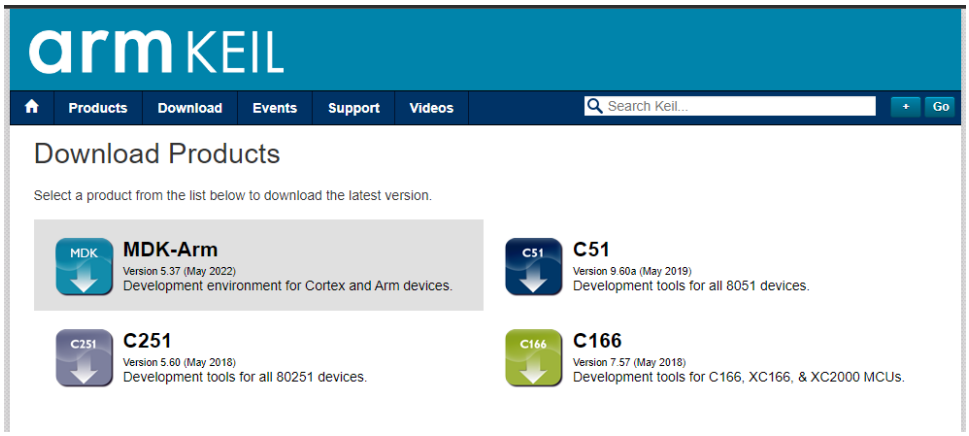
Preface

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.

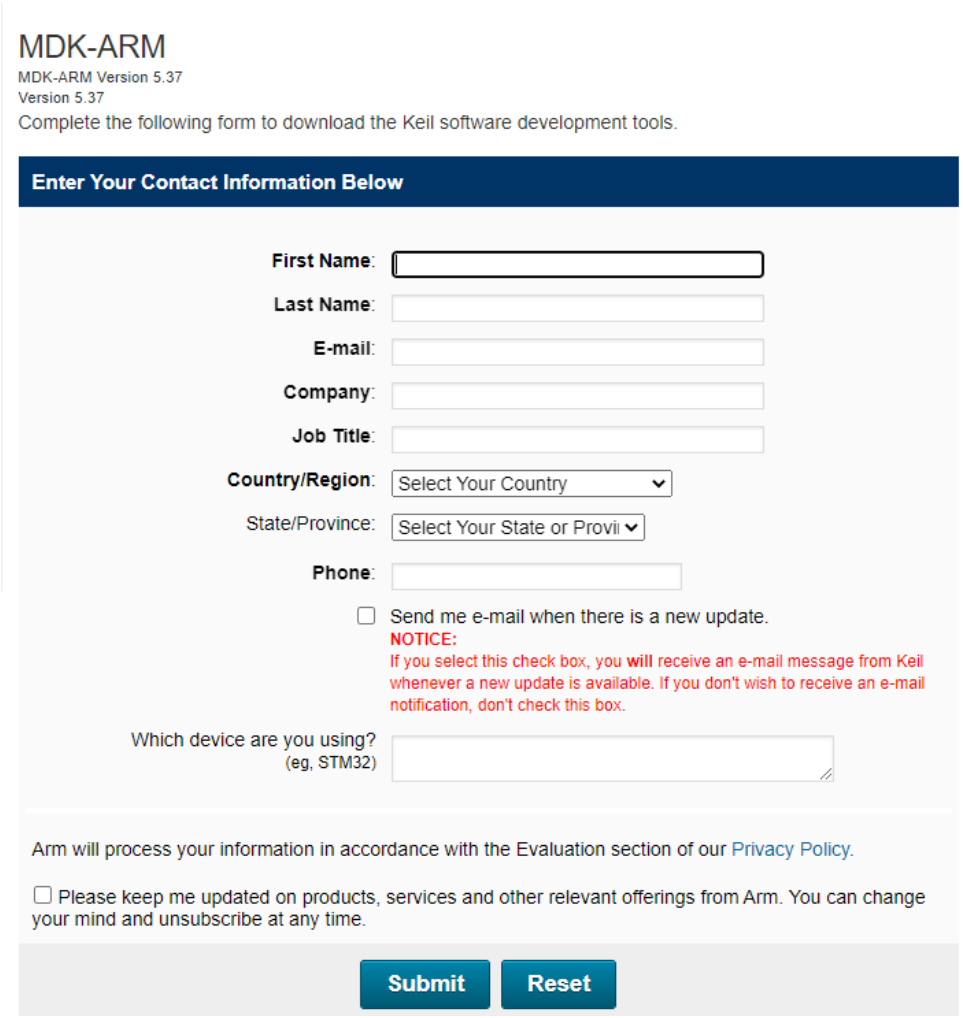
Downloading and Installing µvision IDE

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

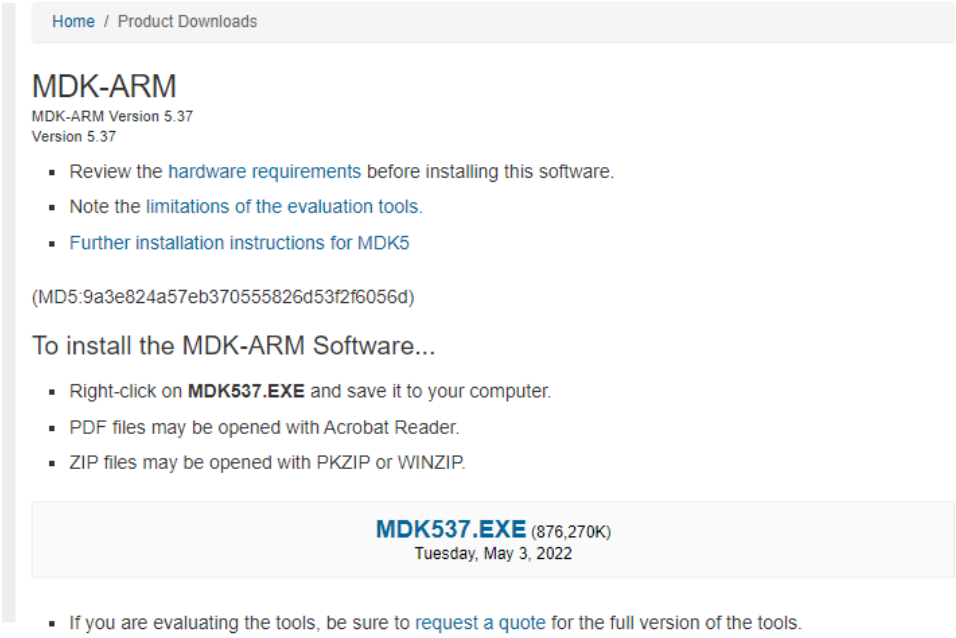


and choose “MDK-Arm”.

2. Fill in your personal particulars



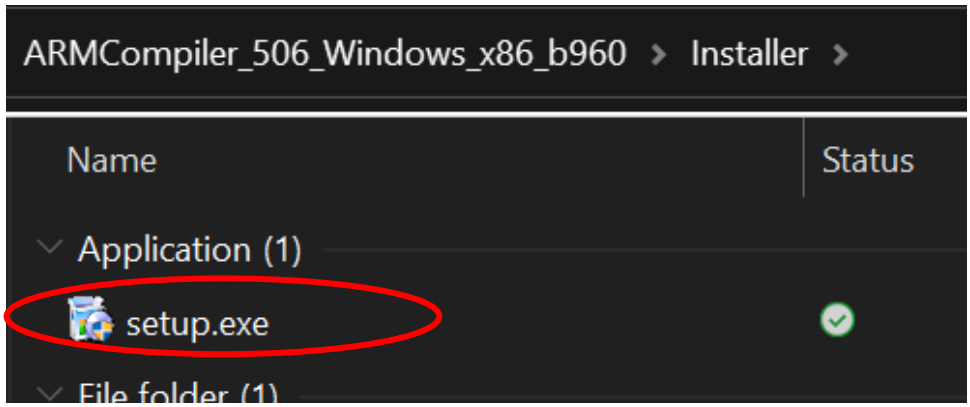
3. Download and install the µvision IDE



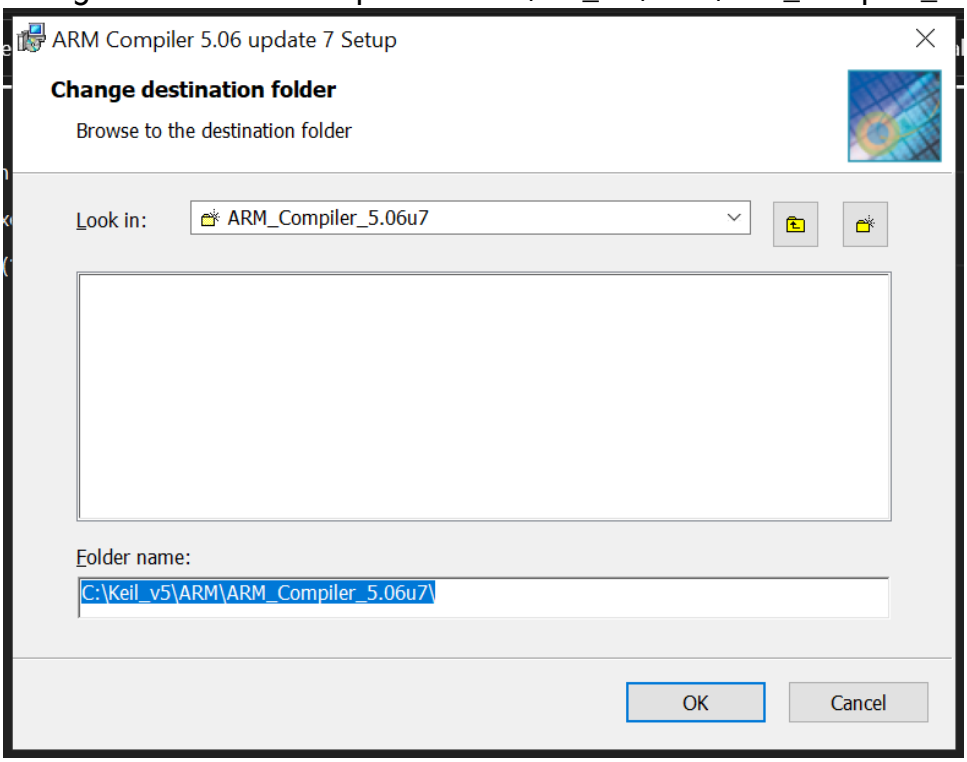
4. Since the STM32 source code we are dealing with is old, the IDE's compilers need to be edited before we can start. Open the following link https://blog.csdn.net/mowwwcom/article/details/124790542

and download the zip file.

5. Open setup.exe

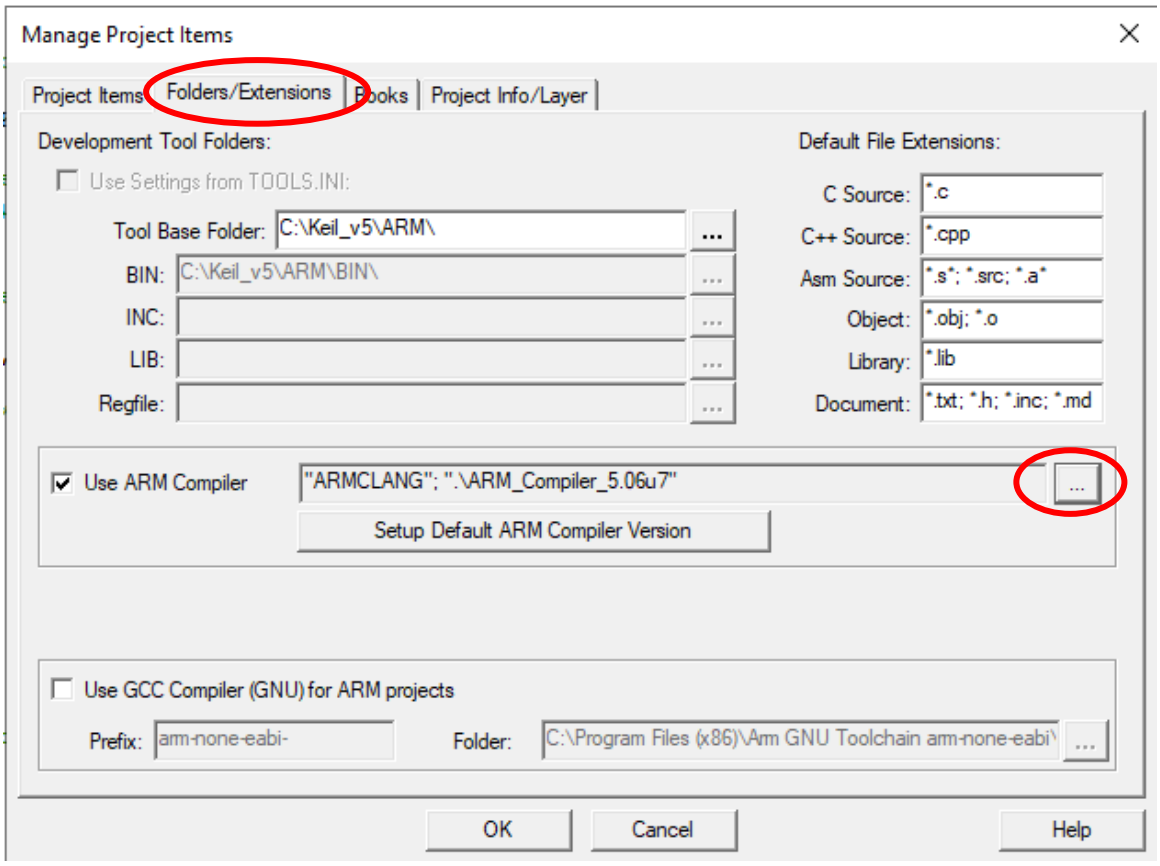


6. Configure the installation path is to C:\Keil_v5\ARM\ARM_Compiler_5.06u7\

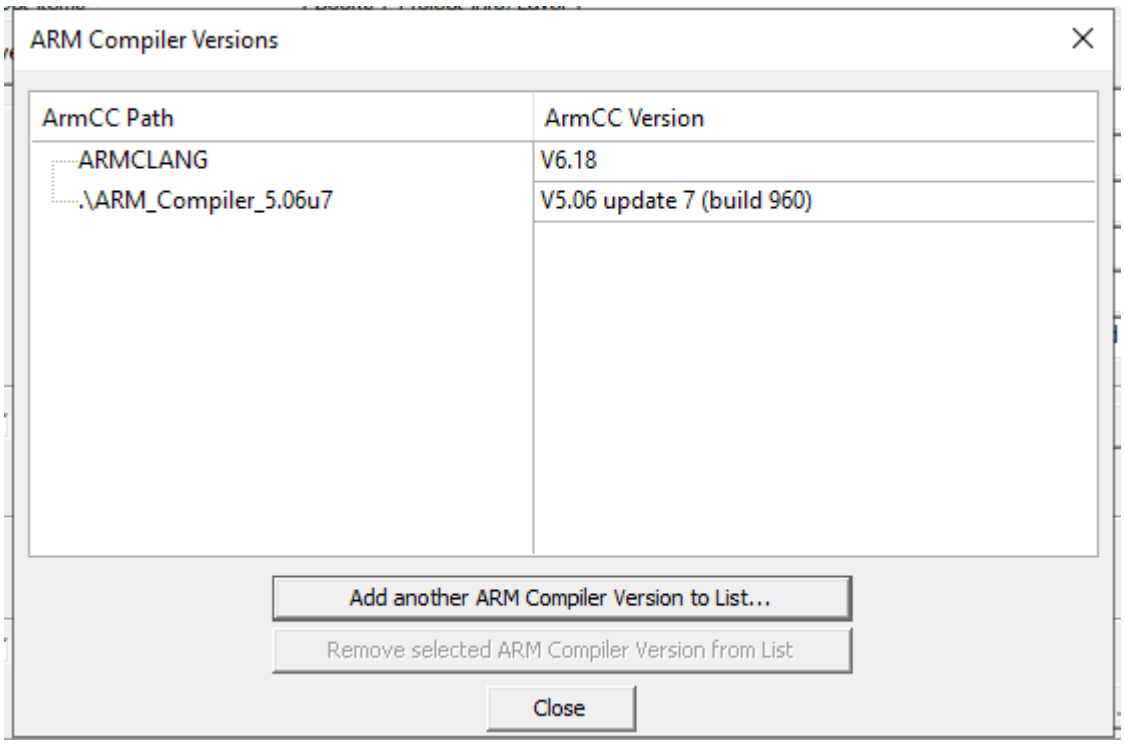


7. Open the µvision IDE and go to Project Items

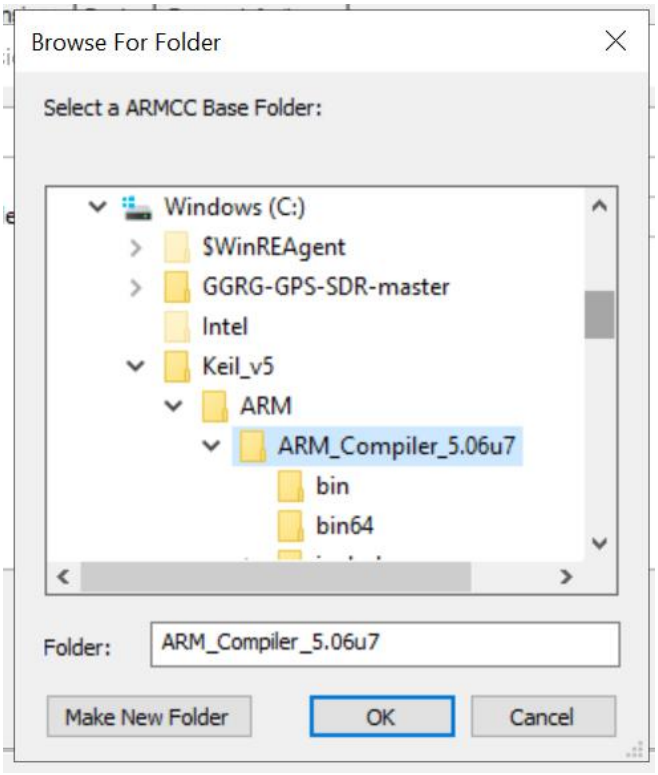
8. Go to Folders/Extensions and click …



9. Go to “Add another ARM Compiler Version to List”

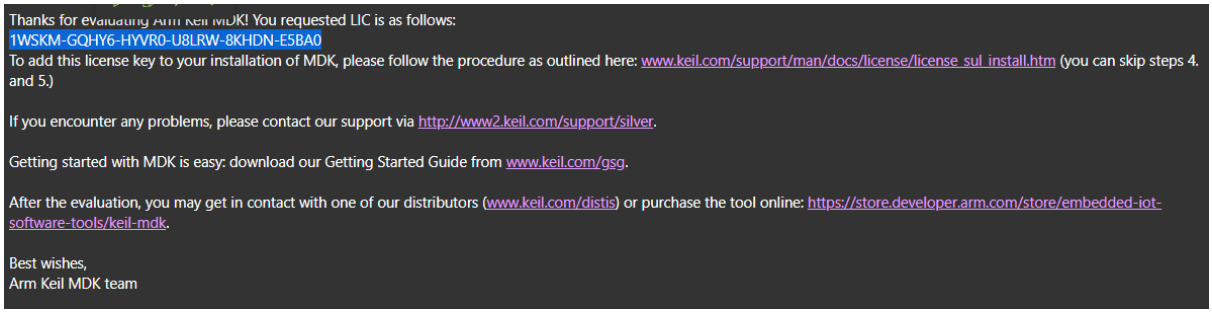


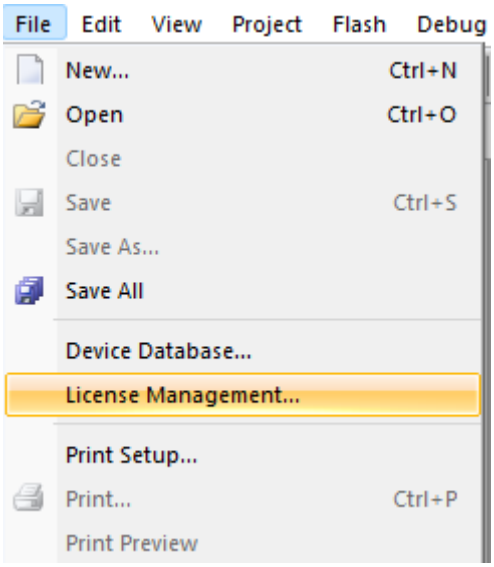
10. Select the ARM_Compiler_5.06u7 folder and click ok

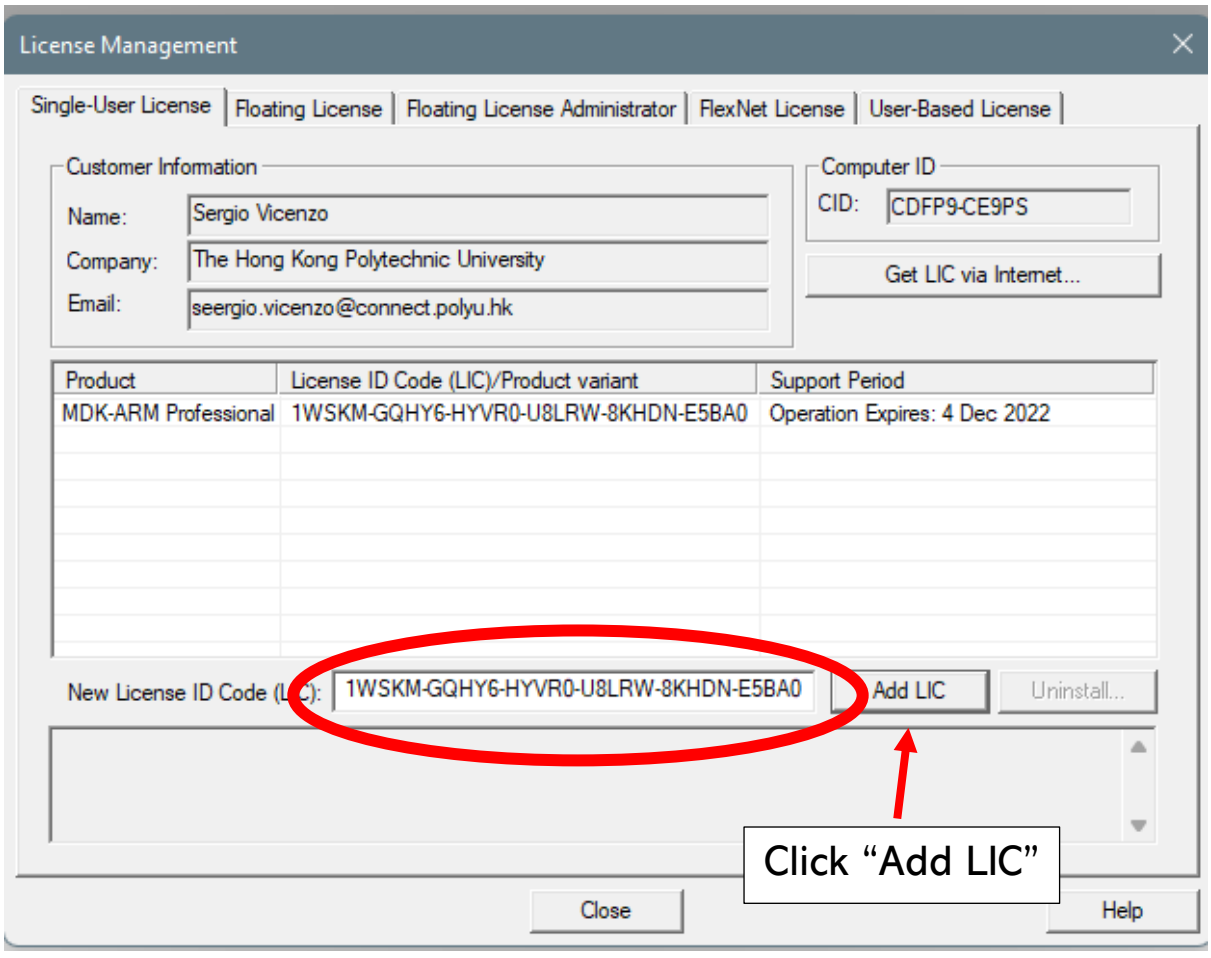


11. Next, since the STM32 source code is large, we need to apply for a Professional version of the IDE. We can apply for a 30-days free trial by going to License Management or clicking the following link https://www.keil.com/MDKEvaluationRequest/

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



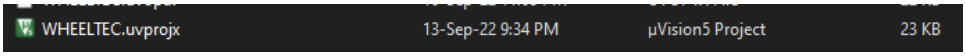

File
Edit
View
Project
Flash
Debug
New... Ctrl+N
Open Ctrl+O
Close
Save Ctrl+S
Save As...
Save All
Device Database...
License Management...
Print Setup...
Print... Ctrl+P
Print Preview


License Management
Single-User License
Floating License
Floating License Administrator
FlexNet License
User-Based License
Customer Information
Name: Sergio Vicenzo
Company: The Hong Kong Polytechnic University
Email: seergio.vicenzo@connect.polyu.hk
Computer ID
CID: CDFP9-CE9PS
Get LIC via Internet...
Product
License ID Code (LIC)/Product variant
Support Period
MDK-ARM Professional
1WSKM-GQHY6-HYVR0-U8LRW-8KHDN-E5BA0
Operation Expires: 4 Dec 2022
New License ID Code (LIC): 1WSKM-GQHY6-HYVR0-U8LRW-8KHDN-E5BA0
Add LIC
Uninstall...
Click “Add LIC”
Close
Help

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

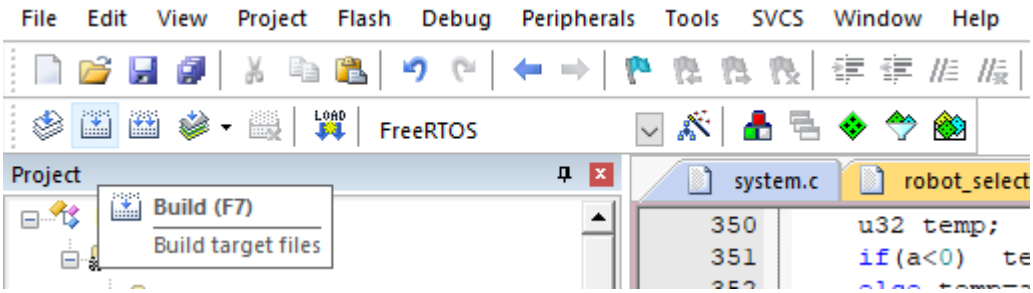


3. Open the project file with the µvision IDE. From here, you are free to alter the STM32's source code, especially the car's PID controller. For example, the motor's PID controller can be found in balance.c

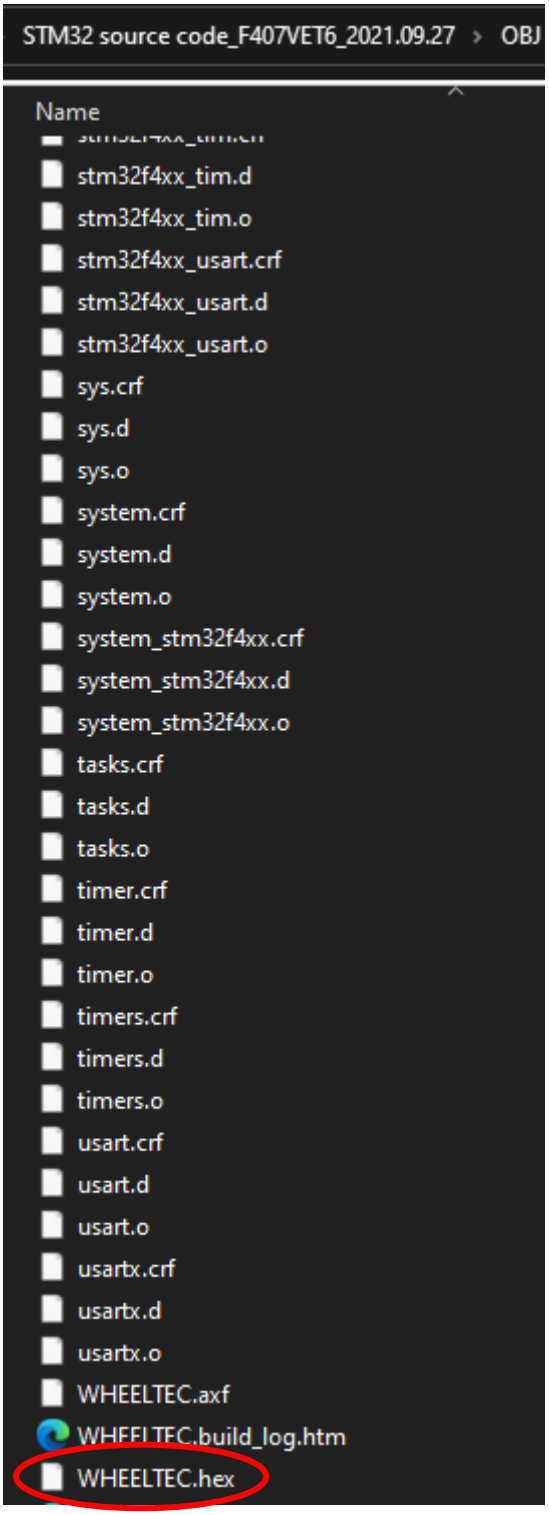
   You are strongly encouraged to explore and modify the PID controller. More marks will be given for those who shows effort in doing so.

```
/**************************************************************************
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.


STM32 source code_F407VET6_2021.09.27 › OBJ
Name
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
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tasks.d
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timer.o
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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 Vicenzo at sergio.vicenzo@connect.polyu.hk.

Thank you and hope you enjoy the project!