

EIE3105

Integrated Project (Part I)

Dr. Lawrence Cheung
Semester 1, 2021/22

Objectives

- To provide students with the concepts and techniques in designing embedded software and hardware interfaces.
- Design and control your robot car to achieve some tasks.

Objectives

- In Semester 1, you focus on learning how to program microcontrollers.
- In Semester 2, you focus on how to design and control your robot car.

Teaching Staff

- Lecturer: Dr. Lawrence Cheung
 - Office: DE628
 - Tel.: 2766 6131
 - Email address: encccl@polyu.edu.hk

Teaching Staff

- Tutor: Mr. Shu-Yuen LAM
 - Office: DE618
 - Tel.: 2766 6239
 - Email address: shuyuen.lam@polyu.edu.hk

Classroom Discipline

Principle 1:

Do not disturb my teaching

Principle 2:

Do not disturb your classmate
if he/she is listening to me

Classroom Discipline

Therefore ...

- Please ask me questions during my teaching. It is important to let me know what you do not understand; otherwise, you will get lost in the rest of the lecture.
- You can type in your question in the chat room and I will reply once I find it.

Preparation

- Students should read through the lecture notes ***at least once*** before attending the class.
- Students are advised to ask specific questions in relation to specific topics rather than asking vague questions.
 - Example: Don't ask "I don't understand Chapter 3. Can you teach me again?"

Email Format

- Should there be any difficulties or problems during non-office hours, the best way to contact me is via email.
- Email format:

Subject: EIE3105 - xxx

Dear Dr. Cheung,

I have a question about

Thanks for your attention.

Regards,

Chan Tai Man

1234567D

Useful Information

- Course web site
 - Blackboard
- Textbook
 - *The AVR Microcontroller and Embedded Systems : Using Assembly and C*, M. A. Mazidi, S. Naimi, and S. Naimi, Pearson, 2014.
 - *The Definitive Guide To The ARM Cortex-M3*, Joseph Yiu, 2nd edition, Newnes, 2010.

Course Schedule

- Lecture
 - Monday, 1:30 p.m. – 3:30 p.m., HJ305
- Laboratory
 - Wednesday, 8:30 a.m. – 11:30 p.m., CF502, CF503 and CF505
 - Start from Week 3
 - Week 1 and 2: Makeup lecture

Course Outline

Week	Lecture	Lab.
1	Introduction: Hardware Connections and C Programming for AVR (Chapter 5, 8 and 9)	Introduction to Computing and AVR (Chapter 1 and 2) (<u>lecture</u> , 9:30 a.m. to 11:30 a.m., venue: <u>Z209</u>)
2	AVR Programming: Timer/Counter, Interrupt, Serial Port (Chapter 10 to 12)	AVR Programming: Timer/Counter, Interrupt, Serial Port (Chapter 10 to 12) (<u>lecture</u> , 9:30 a.m. to 11:30 a.m., venue: <u>PQ304</u>)
3	AVR Programming: Timer/Counter, Interrupt, Serial Port (Chapter 10 to 12)	Lab 1: Introduction to AVR

Course Outline

Week	Lecture	Lab.
4	AVR Programming: Timer/Counter, Interrupt, Serial Port (Chapter 10 to 12)	<u>No lab (The day following Mid-Autumn Festival)</u>
5	AVR Interfacing: LCD, Wave Generating and Capturing (Chapter 13 to 17)	Lab 1: Introduction to AVR
6	Introduction to ARM and C Programming for ARM	Lab 2: AVR Timer/Counter Programming
7	Introduction to ARM and C Programming for ARM	Lab 2: AVR Timer/Counter Programming
8		Quiz 1 (AVR Timer/Counter) Lab 3: AVR Interrupt Programming

Course Outline

Week	Lecture	Lab.
9	ARM Programming: Timer/Counter, Interrupt, Serial Port, PWM and Input Capture	Lab 3: AVR Interrupt Programming
10		Quiz 2 (AVR Interrupt) Lab 4: AVR Serial Port Programming
11		Lab 4: AVR Serial Port Programming
12	Lab 5 ARM Programming	Quiz 3 (AVR Serial Port) Lab 5 ARM Programming
13	Lab 6 Joint Lab	Lab 6 Joint Lab
14	Final Test	

Course Outline (Tentative, Semester 2)

Week	Lecture	Lab.
1 – 2	AVR Interfacing: Keyboard, ADC and DAC	Demonstration 1 Briefing (Hardware Development, Remote Control)
3 – 4	ARM Interfacing: ADC, DMA and SPI	Lab 7: AVR and ARM Interfacing
5 – 13	Demonstration 2 Briefing, Demonstration 2 (Lap Tracking) Demonstration 3 Briefing, Demonstration 3 (Ultra-Sound Sensor Tracking) Demonstration 4 Briefing, Demonstration 4 (Relay Run, group) Presentation and Report Writing	

Interactive Learning

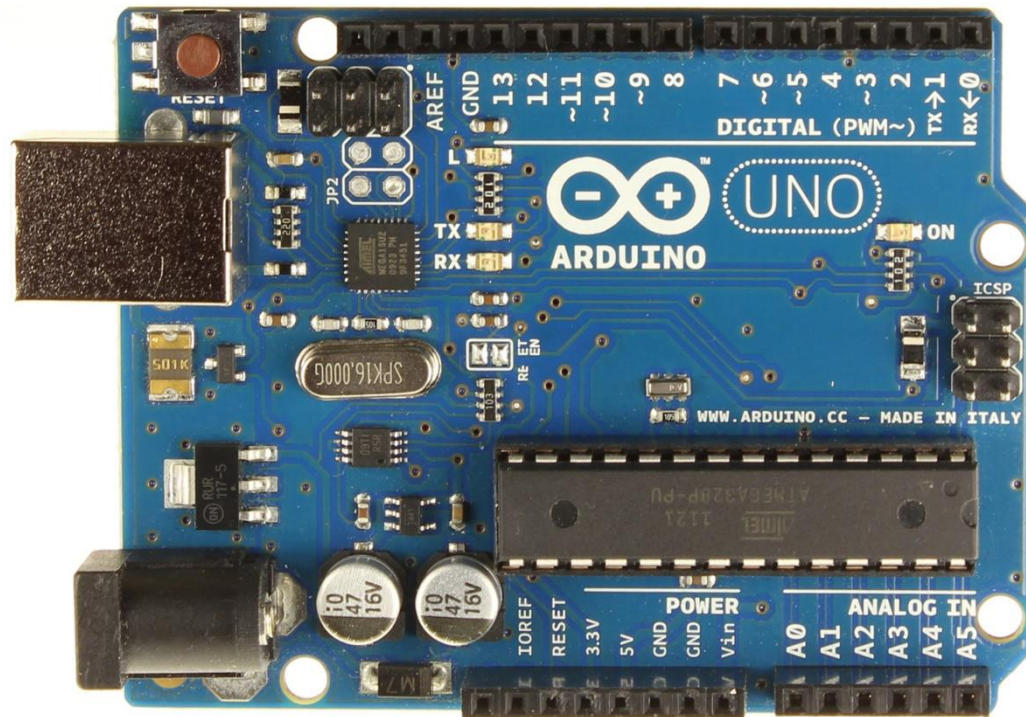
- Laboratory Exercises
 - To practical your programming skills
- Class Exercises
 - To test your programming concept

Continuous Assessment

- Laboratory Exercises (10%)
 - AVR
 - Equipment: Atmel Studio 7 (free software, version: 7.0.1417) and Arduino IDE (free software, version: 1.8.2 or above)
 - Equipment: The Arduino Starter Kit (hardware with circuit boards and some simple hardware devices like LEDs)
 - Microprocessor: ATmega328p
 - Search the above keyword to know more about it.

Continuous Assessment

- Outlook of Arduino Uno (Development board)



Continuous Assessment

Very important: Encourage to buy one by yourself so that you can do it at home.

Buy it as early as possible.

Compatible kit is acceptable (< HK\$200).

You can use it in quizzes and Final Test.

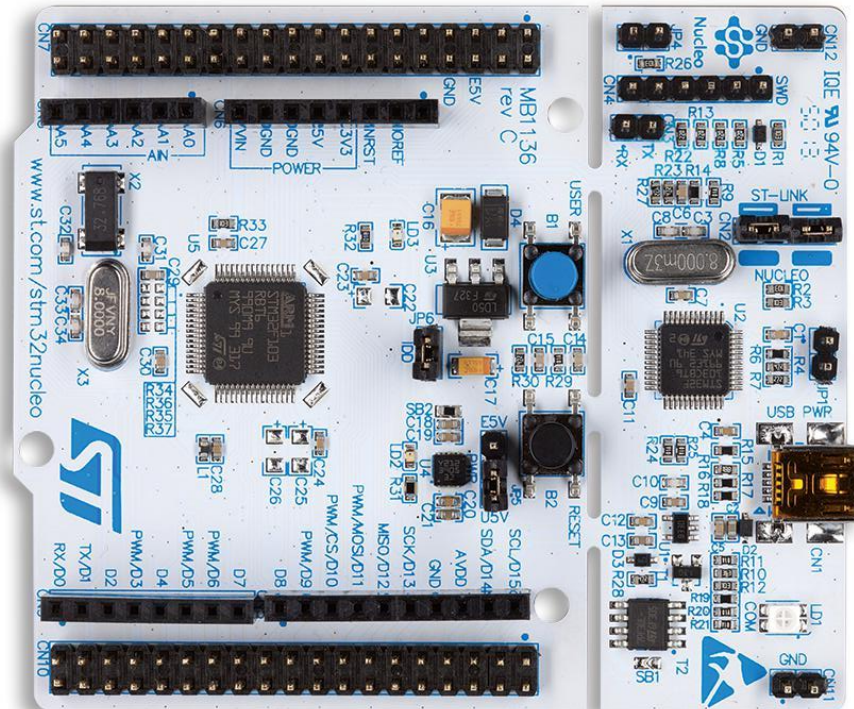
Continuous Assessment

– ARM

- Equipment: Keil uVision5 with ARM support (free software, version: V5.23.0.0)
- Microprocessor: STM32F103RBT6 (ARM Cortex)
- Search the above keyword to know more about it.

Continuous Assessment

- Outlook of STM32F103RBT6 (Development board)



Continuous Assessment

Very important: Encourage to buy one by yourself so that you can do it at home.

Buy it as early as possible.

Compatible kit is acceptable (< HK\$100).

You can use it in quizzes and Final Test.

Continuous Assessment

– 6 Labs

- Lab 1: Introduction to AVR (1%)
- Lab 2: AVR Timer/Counter Programming (1%)
- Lab 3: AVR Interrupt Programming (1%)
- Lab 4: AVR Serial Port Programming (1%)
- Lab 5: ARM Programming (2%)
- Lab 6: Joint Lab (4%)

– Zip all project files into one single file and submit it to Blackboard on or before the deadlines.

Continuous Assessment

– **Deadlines**

- Lab 1 demonstration: 11:30 a.m., 29 Sep 2021
- Lab 1 upload: 11:59 p.m., 1 Oct 2021
- Lab 2 demonstration: 11:30 a.m., 13 Oct 2021
- Lab 2 upload: 11:59 p.m., 15 Oct 2021
- Lab 3 demonstration: 11:30 a.m., 27 Oct 2021
- Lab 3 upload: 11:59 p.m., 29 Oct 2021
- Lab 4 demonstration: 11:30 a.m., 10 Nov 2021
- Lab 4 upload: 11:59 p.m., 12 Nov 2021

Continuous Assessment

– ***Deadlines (continued)***

- Lab 5 demonstration: 11:30 a.m., 24 Nov 2021
- Lab 5 upload: 11:59 p.m., 26 Nov 2021
- Lab 6 upload: 11:59 p.m., 24 Dec 2021
 - Demonstration Video + Program files + Report
 - Zip all of them into one single file.

Continuous Assessment

- ***NO MARKS will be scored*** if you do not demonstrate your programs and results to our tutor or technicians on or before the deadlines.
- Upload your programs to Blackboard on or before the deadlines.
 - Zip all your programs together to a single file and then upload.
- Late submission is ***NOT*** allowed unless you get my approval before the deadline.

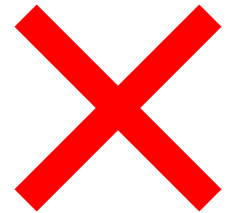
Continuous Assessment

- ***It is very important:*** Usually students score low marks in the final test if they do not do their laboratory exercises seriously.
- ***It is also very important:*** You should follow the sequence to do the laboratory exercises but always try to finish the laboratory exercises as early as possible. You may need more time to finish the last two laboratory exercises.

Continuous Assessment

About doing the laboratory exercises:

“I try but I fail. Then I ask my classmates for help. They tell me the idea and I finally work out the program.”



“I try but I fail. I ask Lawrence for help. He helps me to make my idea works. Thanks.”



Continuous Assessment

- Quizzes (12%, 4%@) (in **lab. sessions**)
 - Quiz 1 (Week 8): AVR Timer/Counter Programming (4%)
 - Quiz 2 (Week 10): AVR Interrupt Programming (4%)
 - Quiz 3 (Week 12): AVR Serial Port Programming (4%)
 - 10:00 a.m. – 11:00 a.m. (1 hour)
 - ONE to TWO programming questions (two versions)
 - Zip all project files into one single file and submit it to Blackboard at the end of a quiz.

Continuous Assessment

– Open-book practical test

- You are allowed to bring your lecture notes, books, and any secondary storages.
- You are NOT allowed to get any information from the Internet.
- At the end, you should follow the guideline to upload your answers to Blackboard.
- Then you demonstrate your program to show whether your program works or not.
- If you do not know why your program does not work in a quiz, we will come to help you after demonstration.

Continuous Assessment

- Final Test (14%)
 - Date: 30 Nov 2021 (Tuesday)
 - Time: 9:00 a.m. to 11:00 a.m. (2 hours)
 - Venue: CF502, CF503 and CF505
 - AVR + ARM
 - Zip all project files into one single file and submit it to Blackboard at the end of the test.
 - Style: same as quizzes but more questions
- More ... Microcontroller Contest

Continuous Assessment

- Marking Criteria for Quizzes and Final Test:
 1. You will score NO marks in a question if your program cannot be compiled successfully or your circuit is not well established.
 2. You will score NO marks in a question if you cannot show any outputs properly.
 3. You will score some marks (usually half) in a question if you can show some reasonable outputs.
 4. You will score FULL marks in a question if you can give the expected outputs in our testing cases.
 5. You are welcome to discuss your case with me if you confuse about my marking.

Important Issues

- Quizzes and Final Test
 - To avoid cheating, you should not open any applications except PDF reader and AVR/ARM development tool(s) only.
 - You should not open any web browsers.
 - All flash drives must be removed before the test starts; otherwise, you will score **no marks** in the test.

Assessment Plan

- Semester 1: 36%
- Semester 2: 64%
 - AVR/ARM Interfacing Lab (2%)
 - AVR/ARM Interfacing Test (4%)
 - Demonstrations 1, 2, 3 and 4 (40%)
 - Logbook (8%)
 - Report and Presentation (10%)

End