

Advanced Embedded systems diploma

By Amgad Samir

About instructor:

- 1- Senior embedded SW engineer at Brightskies company.
- 2- Previous embedded systems & IOT engineer at Smartec-group.
- 3- Previous embedded systems instructor at IMT.
- 4- Previous embedded systems instructor at ITI 3-month diploma.
- 5- Previous embedded systems instructor at ITI 9-month diploma.
- 6- Previous embedded systems instructor at NTI.
- 7- Previous embedded systems instructor at AMIT.

Diploma Duration:

- 1- 268 Hours.
- 2- 4 Hours per session
- 3- 2 sessions per week
- 4- Total duration: 34 weeks

Diploma content:

1- Introduction (4 Hours):

- ❖ Course content.
- ❖ The hardware components.
- ❖ ARM in industry.
- ❖ Tools setup.

2- ARM architecture & STM interfacing part(1) (108 Hours):

- ❖ Memory map & bus system (8 Hrs).
- ❖ Debugging techniques (4 Hrs).
- ❖ STM clocking system (4 Hrs).
- ❖ RCC peripheral & driver development (4 Hrs).
- ❖ Processor modes (4 Hrs).
- ❖ Inline Assembly (4 Hrs).
- ❖ GPIO peripheral & driver development (12 Hrs).
- ❖ PORT driver (4 Hrs).
- ❖ Reset sequence & Instruction set (4 Hrs).

- ❖ Stacking (8 Hrs).
- ❖ Exceptions & Interrupts (8 Hrs).
- ❖ Fault handling (4 Hrs).
- ❖ NVIC (4 Hrs).
- ❖ External interrupt peripheral & driver (4 Hrs).
- ❖ Drivers' enhancement and applications (4 Hrs).
- ❖ DMA (8 Hrs)
- ❖ UART using polling, interrupt, DMA (4 Hrs).
- ❖ SPI using polling, interrupt, DMA (4 Hrs).
- ❖ I2C using polling, interrupt, DMA (8 Hrs).
- ❖ Communication bus sniffing using logic analyzer.
- ❖ Drivers review (4 Hrs).
- ❖ Mega Project (1)

3- Configuration management using Git (16 Hours):

- ❖ Need for version control and configuration management.
- ❖ Git concepts and github.
- ❖ Git using command line.
- ❖ Git using GitExtensions.
- ❖ Introduction to SW integration

4- Interfacing part (2) (48 Hours):

- ❖ ADC using polling, interrupt, DMA (4 Hrs).
- ❖ Timers, PWM, ICU, Watchdog (12 Hrs).
- ❖ Drivers development & review (8 Hrs).
- ❖ Sleep, power down modes (4 Hrs).
- ❖ CAN concepts & driver development (12 Hrs).
- ❖ CAN communication between both STM MCUs (4 Hrs).
- ❖ Communication bus sniffing using logic analyzer.
- ❖ Lin theory and communication (4 Hrs).
- ❖ Mega project (2).

5- RTOS (36 Hours):

- ❖ ARM system level exceptions (4 Hrs).
- ❖ Advanced scheduler implementation using ARM features with context switching (8 Hrs).
- ❖ FreeRTOS porting and simple task training (4 Hrs).
- ❖ Segger J-link tool for time tracing & monitoring (4 Hrs).
- ❖ FreeRTOS objects trainings (16 Hrs):
 - 1- Task states, Idle task, notification mechanism, hook function.
 - 2- Memory management.
 - 3- Task priority & interrupt priority.
 - 4- Synchronization using semaphore & queue.
 - 5- Communication management using queues.
- ❖ Mega project (3).

6- Bootloader course (16 Hours):

- ❖ STM native bootloader exploration & activation.
- ❖ Implementing bootloader from scratch:
 - 1- Jumping to user app.
 - 2- Read commands.
 - 3- Implementing read, write, erase commands.
 - 4- Enhancement with advanced services.

7- Building process and Toolchain (16 Hours):

- ❖ Implementing makefile from scratch.
- ❖ Implementing startup file from scratch.
- ❖ Implementing Linkerscript from scratch.
- ❖ Communication with debugger using server client communication.

8- AUTOSAR (24 Hours):

- ❖ Introduction (4 Hrs).
- ❖ Memory Stack (4 Hrs).
- ❖ Communication Stack (4 Hrs).
- ❖ Diagnostics Stack (4 Hrs).
- ❖ Implement PORT driver & GPIO driver according to AUTOSAR specs (8 Hrs).

9- Final project.

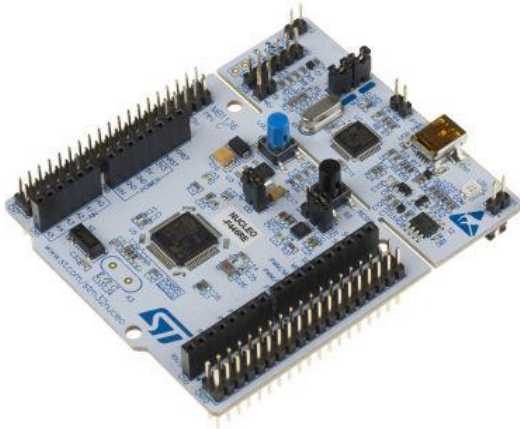
Hardware components

Hardware will be delivered to home for use during the whole diploma, then will be returned back after diploma end.

1- STM32F103 Panda Kit:



2- Nucleo-F446RE with USB-mini cable



- 3- USB Saleae logic analyzer.
- 4- Breadboard.
- 5- Tiny DS1307 RTC Module.
- 6- CJMCU-230 SN65HVD230 CAN Transceiver module.
- 7- Jumper wires, Resistors.
- 8- Plastic box.