001 First session

* What will we learn :-
- Definitions of embedded systems, microcontroller and microprocessor.
- Why using ARM Cortex-M4
- Microcontrollers and Microprocessors structure and working principle.
- Revision on electronics basics, numbering systems, logic design and C programming language. - How to use Tive connected launchpad
- General purpose input output. - controlling the stepper motor
- Interrupts - Timers - Finite state machince(FSM)
- A-D converter and D-A converter and dealing with sensors & sounds

*Communication protocols :-
1- Universal asynchronous Reciever/transmitter (UART)
2- Inter-Integrated circuit (I^2C)
3- Serial peripheral interface (SPI)
4- Control Area network (CAN)
5- Universal serial bus (USB)
- Information exchange in Local Area network or using ethernet
- Information exchange wirelessly using Radio Frequency Module

* What experiences should you have to help you throgh this course?
- Basic knowledge of any programming language and electronics as well.
* Tools that will be used :-
- Tiva connected launcpad
- Multimeter
- Logic analyzer
- Oscilloscope
- Some basic electronics components : Resistors, LED, capacitors, etc....

002 Basic theoretical information

* What is an embedded system?

- An embedded system is a combination of computer hardware & software designed for a specific function.
- Most of modern devices nowadays are embedded systems.

* Microcontrollers is like a mini computer in a single chip. It includes microprocessors and other modules that can be used.
Microprocessors do the computing. We can say that every Microcontroller is a microprocessor

* Types of embedded systems :-

1- Programmable Embedded system. 2- non-programmable Embedded system. (with fixed hardware)

* What is ARM cortex-M4

It is a high performance embedded processor.

- Specifications.:-

1- 32-Bit 2- High performance
3- relatively cheap and better than other processor from the same price
4- Bigger Memory 5- commonly used

* What should be considred during designing embedded systems?

1- Processing speed
2- Memory size
3- Working environment
4- Power consumption
5- Product's lifetime
6- Product's cost

003 Micro controller structure:-

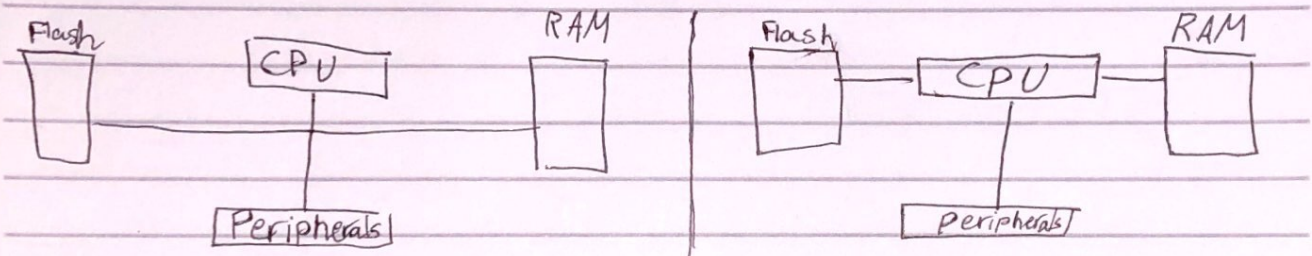
* Why do we use microcontrollers ?

- To connect successfully with other devices
- programmable
- Low Power consumption

* Microcontroller structure :-

- central processing unit (CPU)
- Memory (RAM and Flash are used for different ~~pur~~ purposes)
- Buses
- Peripherals

* Von Neumann vs Harvard ~~structure~~



Von Neumann	Harvard
- Same physical memory address is used for instructions and data	Separate physical memory address is ~~us~~ used for instructions & data
- Common bus for data and and instruction transfer	separat buses for data and instruction transfer
- takes more time to ~~execute~~ execute an instruction	execute instructions faster
- ~~Low cost~~ low cost	High cost
- CPU can't access instructions and read at the same time	CPU can access instructions and read at the same time