Embedded system basics

What is Embedded system?

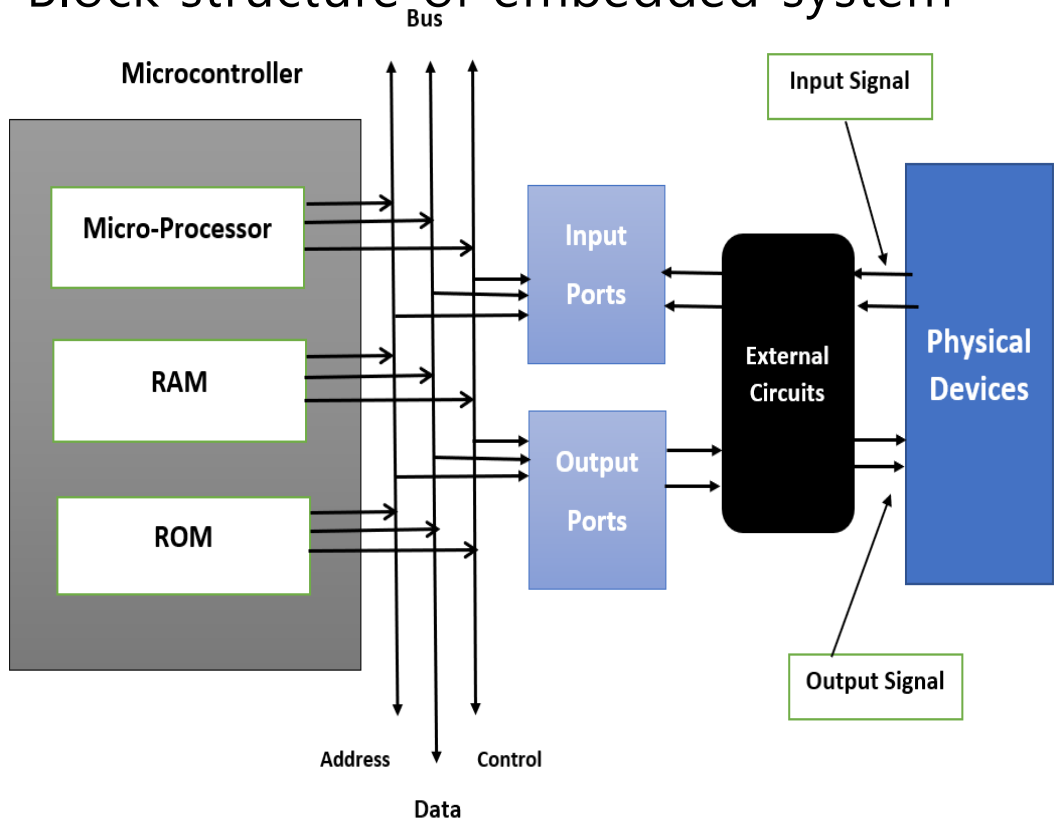
Embedded means including something.

Embedded system is combination of computer hardware and software for a specific function.

Main component of Embedded systems

Hardware, Software, Firmware

Block structure of embedded system



MCU basics

MCU (micro controller unit)

micro controller = small computer

microprocessor + memory + I/O interfaces -> single chip

microcontroller consists of a processor core, RAM, ROM, input/output peripherals.

RAM (random access memory), it is volatile

ROM (read olny memory), it is non-volatile

microcontrollers are widely used in embedded systems

microcontrollers are programmable

Memory (PROM, EPROM, EEPROM, FLASH, D FLASH)

PROM (Programmable Read-Only Memory)

- Written only once
- Written programmed electrically by the user or when the initial chip fabrication

EPROM (Erasable Programmable Read-Only Memory)

- read and written optically
- reused again and again as it is easily programmable and erasable.

EEPROM (Electrically Erasable Programmable Read-Only Memory)

- uses electrical signals to erase and program
- there are two types of EEPROM: Serial EEPROM, Parallel EEPROM

Memory (PROM, EPROM, EEPROM, FLASH, D FLASH)

FLASH Memory

- secondary memory.
- Flash memory works on the principle of EEPROM.
- Flexible: erased multiple times and update the data or program integrated into it
- Fast access times: It supports solid-state technology so it has faster access time.

D FLASH

- user is responsible to erase a block, program new data to flash.
- It is possible to write one double word (64bits) at a time.
- The double word must be fully erased prior to programming.
- It is not allowed to program doubleword which is not in erased state. If it is not in erased state, whole block must be erased (2KB in case of FlexNVM).

Understanding of instruction set, Registers, memory and Program counter register

What is instruction set?

An instruction set is a group of commands for a central processing unit (CPU) in machine language.

What is Register?

A register is a small and temporary storage unit inside a computer.

Registers are utilized for a variety of functions in handling and controlling instructions

What is memory?

Memory devices are digital systems that store data either temporarily or for a long term.

What is Program counter?

register in a PC (program counter) processor that contains the address of the next instruction to be executed from memory.

Understanding of status register

What is status register(SR)?

The status register is a hardware register that contains information about the state of the processor.

SR.Z: verify the value in the register is 0

SR.N: verify the value in the register negetive

If the setting value and register information is same the outcome will be true->1

Else false -> 0

Understanding of MCU instructions (ADD, SUB, MOVE, CMP, and conditional JUMP)

ADD r1 r2 : r2 = r1 + r2

SUB r1 r2: r2 =r2 - r1

MOVE r1 r2: r1 -> r2

CMP r1 r2: compare r1 and r2

First r2 – r1, then use conditional jump.

Conditional JUMP

If the condition is then jump.

Ex) JZ 10. If value in register is zero then jump to 10.

S32K146

Manufactor : NXP

Voltage range: 2.7 V to 5.5 V

Arm™ Cortex-M4F/M0+ core, 32-bit CPU

SPI–3 CAN–3 I2C–1 VART-3 ADC-2 DAC-1

- SPI(Serial Peripheral Interface): short-distance communication between peripheral integrated circuits and microcontrollers
- I2C (Inter-Integrated Circuit): bus interface connection protocol incorporated into devices for serial communication
- UART (Universal Asynchronous Receiver/Transmitter): large-scale integration gadget offbeat is planned to deal with the transmission of sequential information
- CAN (Controller Area Network)
- ADC: Analog-to-Digital Converter
- DAC: Digital-to-Analog Converter