3. Software Industrial IoT

IoT Peripherals

1

Sensors

- Sensors are devices that detect external information, replacing it with a signal that humans and machines can distinguish
- Sensors made it possible to collect data in almost any situation and are now used in various fields
  - Medical care, nursing care, industrial, logistics, transportation, agriculture, disaster prevention, tourism, regional businesses and many more
- Two types of sensors
  - Digital sensors
    - Electronic or electrochemical sensors where data is digitally converted and transmitted
    - Often used for analytical measurements
    - Tend to replace analog sensors
  - Analog sensors
    - devices that produce analog output in correspondence to the quantity being calculated
    - Observe the change measured in external factors

2

Memories

- Volatile Memory
  - Does not retain data after power is removed
  - Has higher per-bit storage costs
  - Usually used for primary storage when the memory interacts with a system-on-chip (SoC) frequently
- Non-Volatile Memory (NVM)
  - Capable of retaining data even after power is removed
  - Has a lower speed than volatile memory
  - Used for secondary/mass storage
  - Now becoming faster and cost per byte is going down, leading to its usage for primary storage as well

3

Memories (continued)

- Embedded multiple-time programmable (MTP)
  - offers small on-chip reprogrammable memory for applications requiring longer battery life, since external memory consumes more power
- One-time programmable (OTP)
  - low in cost, driven by ease of manufacturing
  - allows chips to store custom network media access
    - controller (MAC) addresses
    - data encryption keys
    - network ID
    - authentication codes
    - Firmware
- Embedded Flash Memory (eFlash)
  - Due to its robust endurance, highly desirable in IoT applications requiring storage of critical data and code
  - great flexibility for last minute system-level changes
  - relatively high performance (>6.4 GB/s readout speed) and high density capable of supporting most microcontroller based applications

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Memories (continued)

- Traditional External Flash Memory
  - used in IoT applications around GPS/navigation and in consumer products like smartphones and e-readers due to it
    - low cost
    - high density
    - XIP performance (True for NOR Flash)
    - wide range of temperature support
    - architectural flexibility
    - Reliability
  - Types
    - NOR Flash
      - Very popular among applications requiring code storage, such home gateway and set top boxes, because of its ability to support XIP applications and low standby power consumption
    - NAND
      - Used for data storage applications that do not require XIP support
    - Data heavy IoT applications like intelligent USB drivers and wearable IoT devices require cheaper storage and will use NAND flash due to its low cost and higher capacity storage

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Memories (continued)

- Traditional DRAM (DDR/LPDDR)-Based Memory
  - In systems that requires high end performance and computational power
- eMMC Memory
  - suitable for applications with involving sensors, meters, robots, wearable devices and consumer electronic products because of its low cost and ability to act as a replacement for traditional storage media
  - Simplifies application interface design by moving the flash controller interacting with flash memory in the memory itself
  - Benefits IoT memory developers by reducing the footprint for memory devices and therefore lowering costs
  - allows for fast transfer speeds of up to 400 MB/s and capacities up to 128 GB

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Memories (continued)

- UFS Memory
  - offers higher data transfer speeds and lower power consumption than eMMC
  - expected to drive both the embedded and removable flash memory-based storage in IoT devices
  - Its higher performance is also the result of architectural changes in the interconnect layer
  - Has serial and full duplex interconnect

Transceivers

- The short form of transmitter receiver
- This device comprises both the transmitting and receiving functionalities
- IoT transceiver have been developed to support IoT(Internet of Things) compliant standards
- It can both transmit and receive radio waves using an antenna, for communication purposes

References

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