Lesson-17: NETWORKED EMBEDDED SYSTEMS
Bus Communication for networking

- Each specific I/O device may be connected to other using specific interfaces, for example, with I/O device for example, LCD controller, keyboard controller and print controller.

- Bus communication simplifies the number of connections and provides a common way (protocol) of connecting different or same type of I/O devices.
IO Bus

- Any device that is compatible with a system's I/O bus can be added to the system (assuming an appropriate device driver program is available), and a device that is compatible with a particular I/O bus can be integrated into any system that uses that type of bus.
System Bus and Serial IO bus

Processor of system A

RAM

ROM

Memory bus

Address bus

Data bus

Control bus

Serial bus controller (for example, USB or I2C or CAN)

Serial IO bus

IO Device Interface

IO Device Interface

IO Device Interface

IO Device Interface

Processor of system B

Processor of system C

Processor of system D

Processor of system E
IO Bus

- I/O devices communicate with the processor through an I/O bus, which is separate from the memory bus that the processor uses to communicate with the memory system.
Embedded systems Networking

- Embedded systems connected internally on same IC or systems at very short, short and long distances can be networked using a type of the I/O buses- CAN, I²C, USB, PCI, …
IO Bus for Networking vs. direct connections

- Use of I/O bus, as opposed to direct connections between the processor and each I/O device, very flexible, allowing a system to support many different I/O devices depending on the needs of its users and allowing users to change the I/O devices that are attached to a system as their needs change.
Main disadvantage of an I/O bus

- A bus has a fixed bandwidth that must be shared by all of the devices on the bus.
- Even worse, electrical constraints (wire length and transmission line effects) cause buses to have less bandwidth than using the same number of wires to connect just two devices.
- Essentially, there is a trade-off between interface simplicity and bandwidth.
Example

- A bus has bandwidth of 2 Mb/s (can be used to transfer 2 Mb data in one s.
- If 10 devices are connected, the 2 Mb/s is shared between the networked systems
Serial Bus

1. A serial bus has very few lines and the number of lines as per the protocol
Serial Bus

1. A wide range of I/O devices without having to implement a specific interface for each I/O device. When the I/O devices in the distributed embedded systems are networked at long distances of 25 cm and above, all can communicate through a common serial bus.
Using Internet or intranet, a computer or controller or embedded system IO device interface and globally network with computers and a wide range of devices in the systems.
Parallel Bus

- Using a parallel I/O bus allows a computer or controller or embedded system to interface with a number of internal systems at very short distances without having to implement a specific interface for each I/O device.
Short distances Wireless Bus protocol

- Up to 100 m using wireless personal area network (WPAN)
- WPAN protocol without having to implement a specific wireless interface for each I/O device
- Allows a handheld computer or controller or embedded system I/O device to interface and network with number of handheld system I/O devices of other handheld
Summary
We learnt

- Embedded systems can be distributed and networked using an IO bus or networking protocol
- Serial bus protocols
- Parallel bus protocols
- Internet protocols
- Wireless protocols
End of Lesson 17 of Chapter 3