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ECE Dept.
ARM
VI Sem
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Department of Electronics & Communication Engg.

Course : ARM Microcontroller & ES-15EC62. .   Sem.: 6th (2017-18)

Course Coordinator:

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Sensors and Actuators

Piezo Buzzer

☐ **Piezo buzzer is a piezoelectric device for generating audio indications in** embedded application.

☐ A piezoelectric buzzer contains a piezoelectric diaphragm which produces audible sound in response to the voltage applied to it.

☐ Piezoelectric buzzers are available in two types: 'Self-driving' and 'External driving'.

☐ **The 'Self-driving' circuit contains all the necessary components to** generate sound at a predefined tone. It will generate **a tone on applying the** voltage.

☐ **External driving piezo buzzers su** **generation of different tones.** The **tone can be varied by applying a** **se train to the** piezoelectric buzzer.

Push Button Switch

☐ It is an input device. Push button switch comes in two configurations, namely 'Push to Make' and 'Push to Break'.

☐ **In the 'Push to Make' configuration, the switch is normally in the open** state and it makes a circuit contact when it is pushed or pressed.

☐ **In the 'Push to Break' configuration, the switch is normally in the closed** state and it breaks the circuit contact when it is pushed or pressed.

☐ In the embedded application push button is generally used as reset and start switch.

'LOW' Pulse generator   'HIGH' Pulse generator
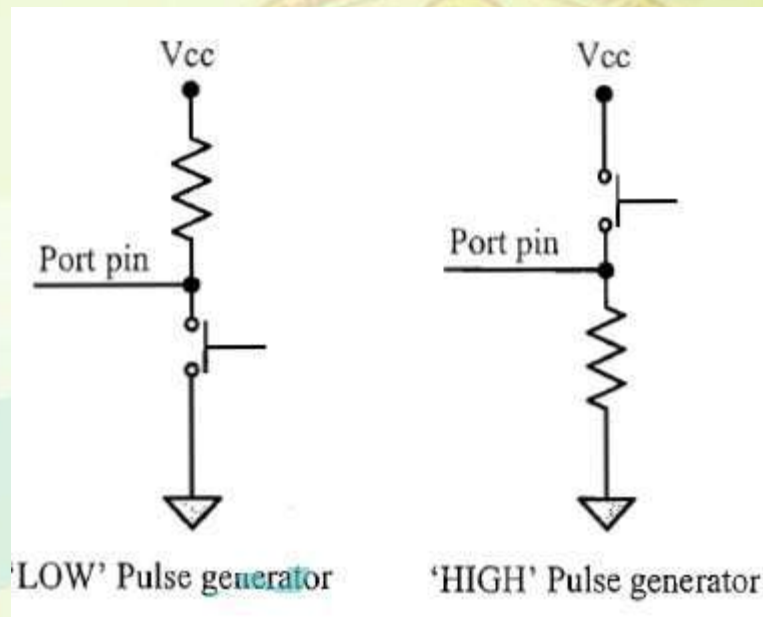
Keyboard

☐ Keyboard is an input device for user interfacing. If the number of keys required is very limited, push button switches can be used and they can be directly interfaced to the port pins for reading.

☐ **Matrix keyboard is an optimum solution for handling large key** requirements. It greatly reduces the number of interface connections.

☐ For example, for interfacing 16 keys, in the direct interfacing technique 16 port pins are required, whereas the matrix keyboard only 8 lines are required. The 16 keys are arranged in a 4 column*4 row matrix.

Matrix Keyboard Interfacing
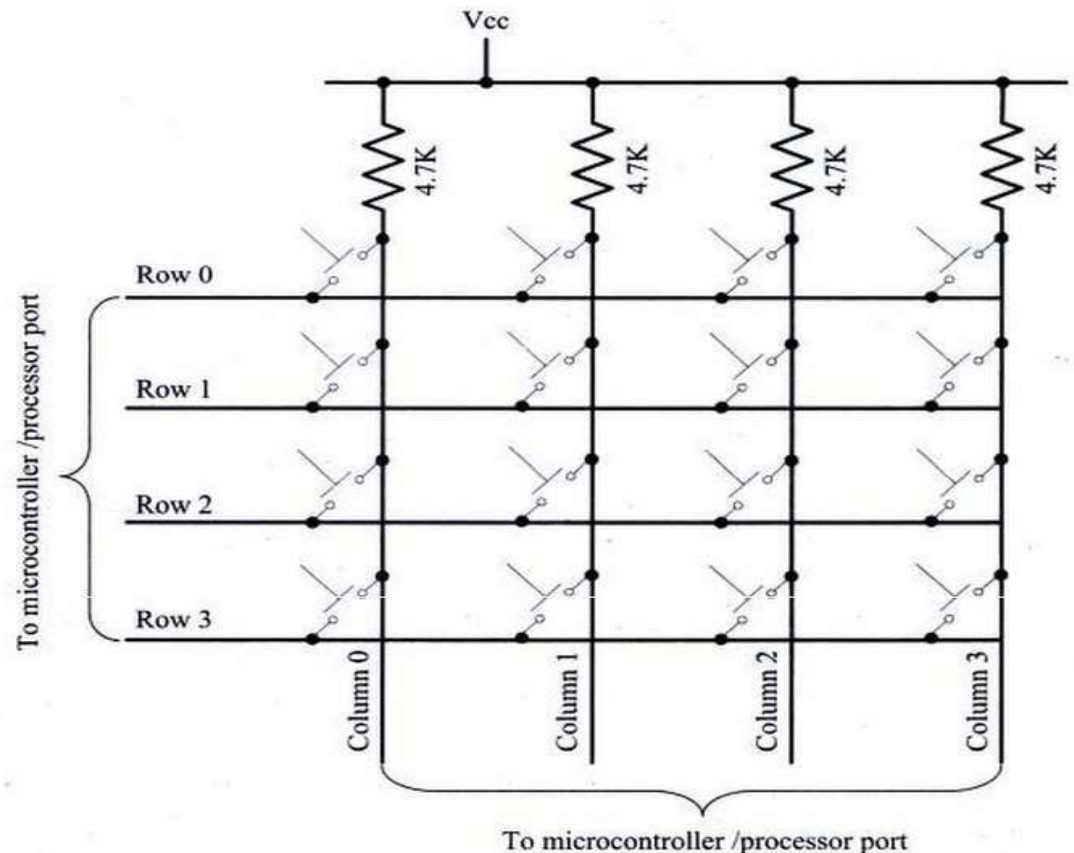
Communication Interface

☐ For an embedded product, the **communication interface can be viewed in two** different perspectives; namely; **Device/board level communication interface** (Onboard Communication Interface) and **Product level communication interface (External Communication Interface).**

☐ **Embedded product is a combination of different types of components** (chips/devices) arranged on a printed circuit board (PCB). **Serial interfaces** like **I2C, SPI, UART, 1-Wire, etc and parallel bus interface are examples of 'Onboard Communication Interface'.**

Onboard Communication Interfaces

 Onboard Communication Interface refers to the different communication channels/buses for interconnecting the various integrated circuits and other peripherals within the embedded system.

The **various interfaces for onboard communication are as follows:**

i. Inter Integrated Circuit (I2C) Bus

ii. Serial Peripheral Interface (SPI) Bus

iii. Universal Asynchronous Receiver Transmitter (UART)

iv. 1-Wire Interface

v. Parallel Interface

Inter Integrated Circuit (I2C) Bus

☐ **The Inter Integrated Circuit Bus is a synchronous bi-directional half duplex** two wire serial interface bus. The I2C bus comprise of **two bus lines, namely;** Serial Clock-SCL and Serial Data-SDA.

☐ **SCL line is responsible for generating synchronization clock pulses and SDA is responsible for transmitting the serial data across devices.**

☐ Devices connected to the I2C bus can act as either 'Master' device or 'Slave' device.

☐ **The 'Master' device is responsible for controlling the communication by initiating/terminating data transfer, sending data and generating necessary** synchronization clock pulses.

☐ **'Slave' devices wait for the commands from the master and respond upon** receiving the commands. 'Master' and 'Slave' devices can act as either transmitter or receiver. **I2C supports multi masters on the same bus.**
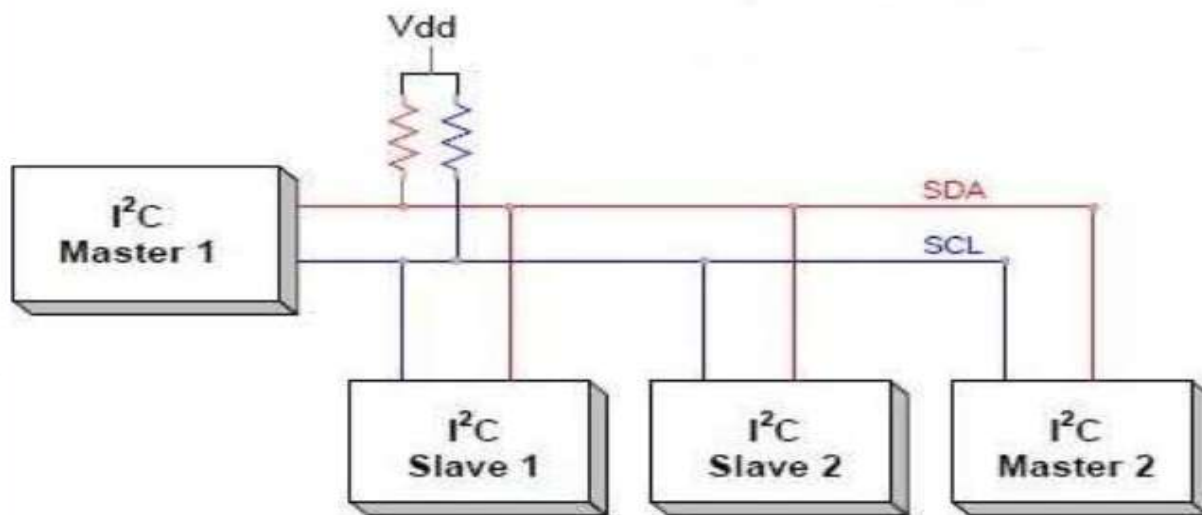
I2C Bus Interfacing

Serial Peripheral Interface (SPI) Bus

☐ **The Serial Peripheral Interface Bus (SPI) is a synchronous bidirectional full duplex four-wire serial interface bus.**

☐ SPI is a single master multi-slave system.

☐ SPI requires **four signal lines for communication. They are Master Out** Slave In (MOSI), Master In Slave Out (MISO), Serial Clock (SCLK) and Slave Select (SS).

☐ When compared to I2C, SPI bus is most suitable for applications requiring transfer of data in 'streams'.
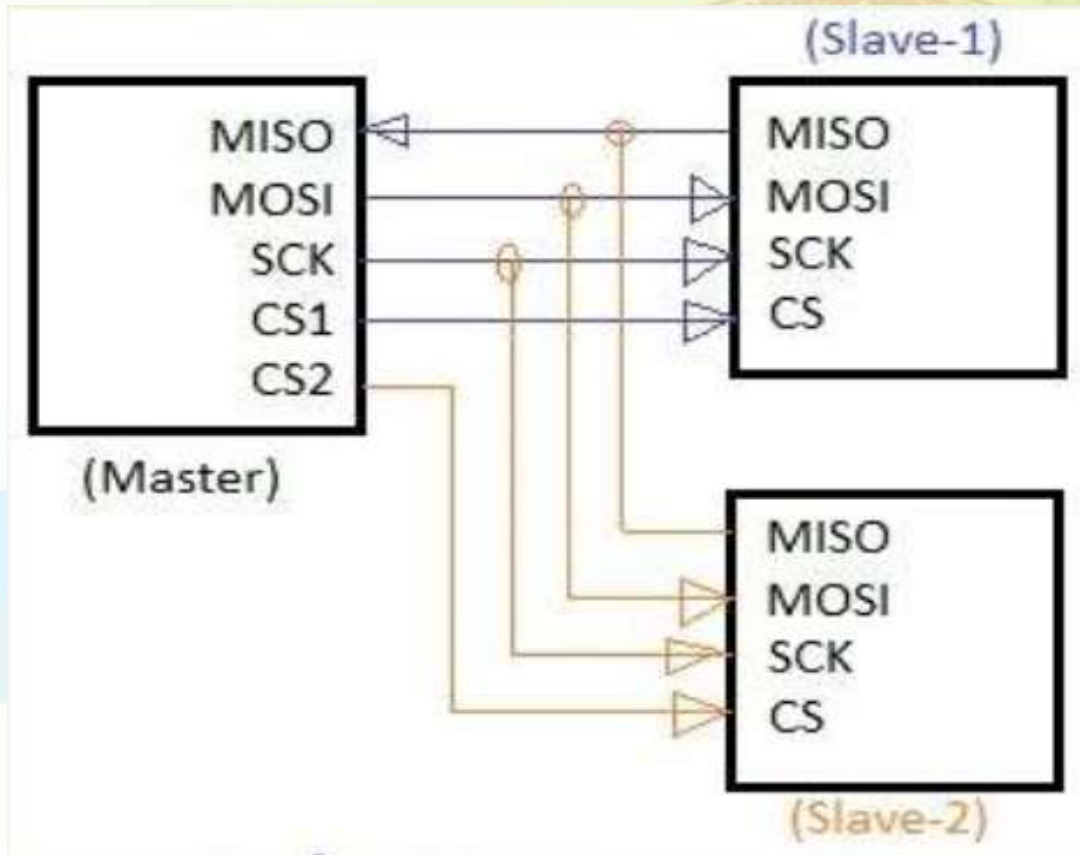
SPI bus interfacing

External Communication Interfaces

☐ The External Communication Interface refers to the different communication
  channels/buses used by the embedded system to communicate with the external
  world. The various interfaces for external communication are as follows
i. RS-232 C & RS-485
ii. Universal Serial Bus (USB)
iii. IEEE 1394 (Firewire)
iv. Infrared (IrDA)
v. Bluetooth (BT)
vi. Wi-Fi
vii. ZigBee
viii.General Packet Radio Service (GPRS)

RS-232 C & RS-485

☐ **RS-232C is a legacy, full duplex, wired, asynchronous serial** communication interface. RS-232 supports two different types of connectors, namely; DB-9; 9-Pin connector and DB-25: 25-Pin connector. RS-232 supports only point-to-point communication and not suitable for multi-drop communication.

☐ **RS-485 is the enhanced version of RS-422 and it supports multi-drop** communication with up to 32 transmitting devices (drivers) and 32 receiving devices on the bus.
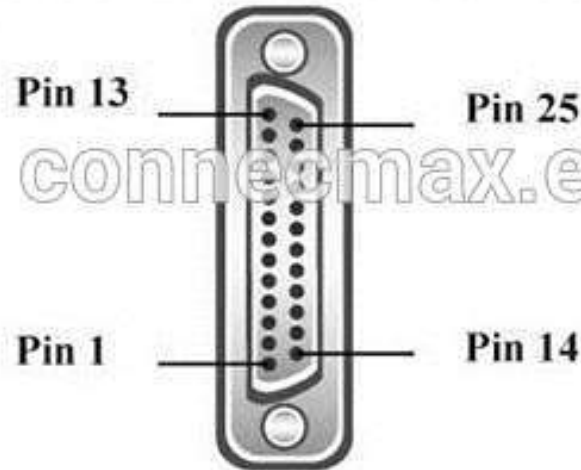
DB-9 and DB-25 RS232 Connector Interface
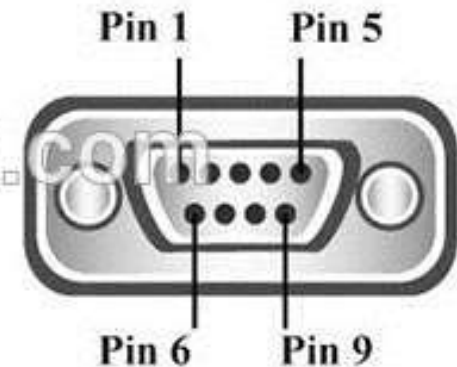
Universal Serial Bus (USB)

□ **Universal Serial Bus (USB) is a wired high speed serial bus for data** communication. The USB host can support connections up to 127, including slave peripheral devices and other USB hosts.

IEEE 1394 (Firewire)

☐ **IEEE 1394 (Firewire) is a wired, isochronous high speed serial** communication bus. It is also known as High Performance Serial Bus (HPSB).

☐ **1394 is a popular communication interface for connecting embedded** devices like Digital Camera, Camcorder, Scanners to desktop computers for data transfer and storage.

☐ **Unlike USB interface, IEEE 1394 doesn't require a host for** communicating between devices. For example, you can directly connect a scanner with a printer for printing. The data rate supported by 1394 is far higher than the one supported by USB 2.0 interface. The 1394 hardware implementation is much costlier than USB implementation

Infrared Data Association (IrDA)

☐ **Infrared (IrDA) is a serial, half duplex, line of sight based wireless** technology for data communication between devices. It is in use from the olden days of communication and you may be very familiar with it. The remote control of your TV, VCD player, etc works on Infrared data communication principle.

Bluetooth (BT)

Bluetooth is a low cost, low power, short range wireless technology for data and voice communication. Bluetooth supports point-to-point (device to device) and point-to-multipoint (device to multiple device broadcasting) wireless communication

☐ A Bluetooth device can function as either master or slave. When a network is formed with one Bluetooth device as master and more than one device as slaves, it is called a **Piconet. A Piconet supports a** maximum of seven slave devices.

☐ Bluetooth is the favorite choice for short range data communication in handheld embedded devices. Bluetooth technology is very popular among cell phone users as they are the easiest communication channel for transferring ringtones, music files, pictures, media files, etc between neighboring Bluetooth enabled phones.

☐ It supports a data rate of **up to 1 Mbps and a range of approximately 30 feet for data communication.**

Wi-Fi

☐ **Wi-Fi or Wireless Fidelity is the popular wireless communication** technique for networked communication of devices. Wi-Fi is intended for network communication and it supports Internet Protocol (IP) based communication. It is essential to have device identities in a multipoint communication to address specific devices for data communication.

☐ **Wi-Fi based communications require an intermediate agent called** Wi-Fi router /Wireless access point to manage the communications. Wi-Fi supports data rates ranging from 1 Mbps to 150 Mbps and offers a range of 100 to 300 feet.

ZigBee

☐ **ZigBee is a low power, low cost, wireless network communication** protocol based on the IEEE 802.15.4-2006 standard.

☐ ZigBee is targeted for low power, low data rate and secure applications for Wireless Personal Area Networking (WPAN).

☐ ZigBee operates worldwide at the unlicensed bands of Radio spectrum, mainly at 2.400 to 2.484 GHz, 902 to 928 MHz and 868.0 to 868.6 MHz.

☐ ZigBee supports an operating distance of up to 100 meters and a data rate of 20 to 250Kbps.

ZigBee device categories are as follows:

☐ **ZigBee Coordinator (ZC)/Network Coordinator: The ZigBee coordinator** acts as the root of the ZigBee network. The ZC is responsible for initiating the ZigBee network and it has the capability **to store information about the network.**

☐ **ZigBee Router (ZR)/Full Function Device (FFD): Responsible for passing information from device to another device or to another ZR.**

☐ **ZigBee End Device (ZED)/Reduced Function Device (RFD): End device** containing ZigBee functionality **for data communication.**

General Packet Radio Service (GPRS)

☐ **GPRS is a communication technique for transferring data over a** mobile communication network like GSM.

☐ GPRS supports a theoretical maximum transfer rate of 17.2 kbps.

☐ The GPRS communication divides the channel into 8 timeslots and transmits data over the available channel.

Queries …?