SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

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UNIT 2 :**DEVICES AND EMERGING BUS STANDARDS**

TOPIC 1 : I/O Devices:- Types and Examples of I/O devices

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

INTRODUCTION TO I/O

Input/Output Organization

The computer system's *input/output* (I/O) architecture is its interface to the outside world.

Till now we have discussed the two important modules of the computer system -

The processor and

The memory module.

The third key component of a computer system is a set of **I/O modules**

Each I/O module interfaces to the system bus and controls one or more peripheral devices.

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

PROGRAM CONTROLLED I/O

There are three basic forms of input and output systems –

- **Programmed I/O**
- **Interrupt driven I/O**
- **Direct Memory Access(DMA)**

Programmed I/O

The processor executes a program that gives its direct control of the I/O operation, including sensing device status, sending a read or write command, and transferring the data.

Interrupt driven I/O

The processor issues an I/O command, continues to execute other instructions, and is interrupted by the I/O module when the I/O module completes its work.

In Direct Memory Access (DMA),

The I/O module and main memory exchange data directly without processor involvement.

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

Interrupt driven I/O

The problem with programmed I/O

The processor has to wait a long time for the I/O module of concern to be ready for either reception or transmission of data. The processor, while waiting, must repeatedly interrogate the status of the I/O module.

This type of I/O operation, where the CPU constantly tests a part to see if data is available, is polling, that is, the CPU Polls (asks) the port if it has data available or if it is capable of accepting data. Polled I/O is inherently inefficient.

The solution →interrupt mechanism

In this approach the processor issues an I/O command to a module and then go on to do some other useful work. The I/O module then interrupt the processor to request service when it is ready to exchange data with the processor. The processor then executes the data transfer. Once the data transfer is over, the processor then resumes its former processing.

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

Direct Memory Access

The data transfer between the processor and I/O devices.

Two different approaches namely

1. Programmed I/O
2. Interrupt-driven I/O.

•Both the methods require the **active intervention of the processor** to transfer data between memory and the I/O module,

- any data transfer must transverse a path through the processor.

Thus both these forms of I/O suffer from two inherent drawbacks.

- •The I/O transfer rate is limited by the speed with which the processor can test and service a device.
- •The processor is tied up in managing an I/O transfer; a number of instructions must be executed for each I/O transfer.

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

To transfer large block of data at high speed, a special control unit may be provided to allow transfer of a block of data directly between an external device and the main memory, without continuous intervention by the processor. This approach is called ***direct memory access*** **or DMA.**

DMA transfers are performed by a control circuit associated with the I/O device and this circuit is referred as DMA controller. The DMA controller allows direct data transfer between the device and the main memory without involving the processor.

EVALUATE

Q 1: What are the functions of an I/O module?

Q 2: Briefly explain the techniques for performing I/O.

Q 3: What are the differences between memory mapped I/O and isolated I/O?

Q 4: Why we use and I/O module to connect the peripheral devices to the CPU?

Q 5: When a device interrupt occurs, how does the processor determine which device issued the interrupt ?

Q 6: How an interrupt mechanism works- explain briefly?

Q 7: Explain the concept of daisy chain mechanism for device identification.

Q 8: What are the advantages of using DMA?

Q 9: Explain the DMA module and its function.

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

Buses

The *processor*, *main memory*, and *I/O devices* can be interconnected through common data communication lines which are termed as *common bus*.

The primary function

To provide a communication path between the devices for the transfer of data.

The bus includes the control lines needed to support interrupts and arbitration.

The bus lines used for transferring data may be grouped into three categories:

- data,
- address
- control lines.

- A single R/W line → Read or Write operation.
- Byte, word, or long word, control signals → the size of data.
- The bus control signal also carry timing information to specify the times at which the processor and the I/O devices may place data on the bus or receive data from the bus.

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

control lines.

- Memory write: Causes data on the bus to be written into the addressed location
- Memory read: Causes data from the addressed location to be placed on the bus
- I/O write: Causes data on the bus to be output to the addressed I/O port
- I/O read: Causes data from the addressed I/O port to be placed on the bus
- Transfer ACK: Indicates that data have been accepted from or placed on the bus
- Bus request: Indicates that a module needs to gain control of the bus
- Bus grant: Indicates that a requesting module has been granted control of the bus
- Interrupt request: Indicates that an interrupt is pending
- Interrupt ACK: Acknowledges that the pending interrupt has been recognized
- Clock: Is used to synchronize operations
- Reset: Initializes all modules

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

External Memory

•Main memory →important role in the working of computer.

•computer works on ***Von-Neuman*** **stored program** principle.

•To keep the information in main memory and CPU access the information from main memory.

The main memory is **made up of semiconductor device and by nature it is volatile.**

For **permanent storage** of information we need some **non volatile memory.**

The memory devices need to store information permanently are termed as ***external memory*****.**

While working, the information will be transferred from external memory to main memory.

The devices need to store information permanently are either magnetic or optical devices.

Magnetic Devices:

- Magnetic disk (Hard disk)
- Floopy disk
- Magnetic tape

Optical Devices:

- CD- ROM
- CD-Recordable(CD –R)
- CD-R/W
- DVD

I/O DEVICES:- TYPES AND EXAMPLES OF I/O DEVICES

DISK PERFORMANCE PARAMETER

When a disk drive is operating, the disk is **rotating at constant speed.**

To *read* or *write*, the head must be positioned at the desired tack and at the beginning of the desired *sector* on the *track*.

Track selection involves moving the head in a *movable-head system* or electronically selecting one head on a fixed head system.

On a ***movable-head system***, the time taken to position the head at the track is known a *seek time*.

Once the track is selected, the disk controller waits until the appropriate sector rotates to line up with the head. The time it takes to reach the beginning of the desired sector is known as *rotational delay* or *rotational latency*.

The sum of the *seek time*, (for movable head system) and the ***rotational delay*** is termed as ***access time*** of the disk, the time it takes to get into appropriate position (track & sector) to read or write.

Once the head is in position, the read or write operation is then performed as the sector moves under the head, and the data transfer takes place.

EVALUATE

Q 1: What is synchronous bus and asynchronous bus?

Q 2: What is the advantages of using multiple clock in synchronous bus?

Q 3: Explain the hand shake control of data transfer for asynchronous bus.

Q 4: How are the data written onto a magnetic disk?

Q 5: How are the data read from a magnetic disk?

Q 6: Define track, cylinder and sector.

Q 7: Define the term seek time, rotational delay and access time.

Q 8: What is zone and sector of a disk and how they differ?

Q 9: Explain the fixed head and movable head disk unit.

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SUMMARY & THANK YOU

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