UNIT-II

2.1 HARD DISK DRIVE AND CONTROLLER

- Hard disk is prime storage area for storing programs and data.
- Data stored on metal platters, cannot be bend or flex.
- Platters are not removable also called **fixed drives.**
- 1960, IBM released hard disk with metal platters and floating heads.
- Manufactured from Winchester
- Capacity was 30 megabytes.
- Nick name Winchester 30-30 drive after famous Winchester 30-30 rifle.



HARD DISK DRIVE

2.1.1 HARD DISK DRIVE SUB-ASSEMBLES

- HDD is made up of physical components:
 - Disk platters
 - Read/write head
 - Head actuator
 - Spindle motor
 - Logic board
 - Cable and connectors
 - ➢ Bezel or face plate
- Platters, spindle motor, heads and actuator mechanism are contained sealed chamber called **HD** Assembler is treated as single component.
- Logic board's bezel mounting hardware are external components of a drive.

1) HEAD ACTUATOR

- It is the mechanical system that moves read/write heads across the disk
- two main types
- Stepper motor actuators(SMA)
- Voice coil actuators(VCM)
- Stepper motor actuator is less reliable than voice coil actuator
- Voice coil actuators for more expensive.
- HD capacity less than 100MB employ SMA for cost-effective reason.
- HD above 100MB employs only VCM considering over all reliability.

Stepper Motor Actuator:

- Stepper motor an electrical motor that 'steps'(or)moves from position to position
- It cannot position itself between step positions.
- Motors are physically small about 1 to 3 inches.

Split Band Mechanism:

- In the split band technique, the band used special alloys to limit thermal expansion
- Spindle rotates, band winds on the spindle rod.
- Moves the head in (or)out providing linear travel across the width of HD.

Rack and Pinion Gear Mechanism:

- This type small pinion geared the spindle of stepper motor moves rack gear in and out.
- Rack gear is connected to the head rack causing to move.
- Rack and pinion mechanism is more durable than the band mechanism.

Voice Coil Actuator:

• Used same as the mechanism the audio speaker.

Special Advantage:

- Using voice coil positioned is automatic parking.
- HD powered off, heads are pulled back into platters to land by spring tension.

HARD DISK



2) SPINDLE MOTOR

- Spindle motor spins the platters to the spindle.
- Motor directly connected to spindle of platters.
- Platters revolve exactly 3600rpm.
- Speed of motor to controlled very precisely.
- Some drives have the motor outside HDA and some drive motor mounted in centre of platters.
- •

3) LOGIC BOARDS

- Disk drive has board containing electronics that control drive's spindle and head actuator system.
- This are called logic boards
- May be one or more such board
- Removed and replaced to rectify logic board problem
- Controller built on drive reducing

2.1.2 HARD DISK CONTROLLER

- Hard Disk executes communication between CPU and disk drive.
- Hard Disk a received control signal from drive is communicated the processor.
- Data written with write with three compensation signal.
- Read data is clock pluses.
- Early system has IC's controller in the motherboard.
- Latest system has IDE and SCSI controller card are available to manage advanced hard disk

1) HDC-functional Blocks

- Major functional blocks in disk controller
 - System interface unit
 - Sector buffer RAM
 - ➢ HDC BIOS ROM
 - Timing and control unit
 - ➢ Hard disk controller
 - ➢ Read/write logic
 - Drive interface logic



HDC-FUNCTIONAL BLOCKS

2) HDC Functions

System Interface Unit:

- Communication between CPU and HDC is established the system interface unit.
- HDC communication to CPU and DMA controller
- Sometimes CPU can passed HDC working with DMA controller
- CPU sends commands to HDC the hard disk

Sector Buffer RAM:

- Temporary storage during read and write commands.
- Data RAM stored information of disk format

HDC BIOS ROM:

- Stores I/O drive for hard disk operation.
- After restart command or power on ram BIOS will do sell test on HDC

Timing and Control Unit:

• Generates different timings and control signals for I/O interface.

Read Write Logic:

- Converts the system byte from parallel to serial.
- Data are analyzed through write pre-compensation circuit.
- Serialized converts.
- Converts data from the disk. (i.e.) serial to parallel and send it to CPU is called deserialized convert.

Drive Interface Logic:

- Function is used to find the error code check
- During write operations during read operation

2.1.3 INTERFACE TYPES

- Connecting HDD to main computer system
- H/W interfacing makes physical connection between computer and drive.
- S/W interfacing deals computer manages the data instruction.
- Multi i/o cards available serial and parallel ports
- Two HDD interface types

> IDE

- > SCSI
- ST-506/412 and ESDI two popular interface standards.

<u>1)</u> IDE

- Stands for Integrated Drive Electronics
- ST-506/412 interface controller card the expansion slot and drive was connected through cables
- Laid restriction shard disk design data transfer techniques
- HDD manufacturer controller card integrated reliable and less expensive
- All drive electronics installed on drive itself.
- Does not need a separate interface card.
- "Dumb adapter" used make the connections.
- Ports to connect
 - Floppy drive
 - ➢ Two serial ports
 - ➢ Game port
 - > Parallel port

Basic IDE read/write timing (non-DMA)



IDE

2) <u>SCSI</u>

- Stands for Small Computer System Interface
- Interface not drive level interface but system level interface
- Not controller single device
- Eight controllers plugged into single SCSI system and communicate each other.
- Controllers called host adapter
- SCSI card plugged into slot in PC

- SCSI not directly works with hard disk.
- Disk drive needs controller to talk to SCSI
- SCSI interface device connected given unique device identification number called SCSI ID.
- Number helps SCSI controller to identify device during data communication.



SCSI FEMALE CONNECTOR

3) ATA/EIDE/ATA-2

- IDE and ATA(AT Attachment interface) one and same
- ATA formal standard that defines drive and how it operates
- IDE trade name and refers to 40-pin interface
- Drive controller architecture designed implement the ATA standard.
- ATA was designed for hard disk only
- 1990 ATA-2 or Fast standard was introduced

Feature of ATA-2

- ➢ Faster PIO(Programmed I/O)
- ➢ Faster DMA data transfer modes
- > More powerful drive commands
- Support for second drive channel
- Support for block data transfers

ATA-3/ULTRA-ATA/33/ULTRAATA/66

- ATA standard ATA-3 offers password based security scheme
- Sophisticated power management features
- ULTRA-ATA/66 has 66MB/s data transfer rate.

4) RAID (REDUNDANT ARRAY OF INDEPENDENT DISKS)

- Not standard. Means of protecting valuable data by consistent back-up routines.
- Controller writes data to one drive, in RAID.
- One or more drives made to mirror master drive in real time.
- Typical RAID controller supports four general operating modes

RAID 0	-	Striping
RAID 1	-	Mirroring
RAID (0+1)	-	Striping & mirroring
JBOD	-	Spanning



RAID controller

RAID θ – Striping

- Striping mode two or more smaller drives from one large drive
- Data are interleaved between multiple drives.
- Performance enhancement rather than fault tolerance
- RAID 0 does not provide redundancy and hence.

RAID 1- Mirroring

- Writing data onto a pair of drives is called mirroring.
- Data is duplicated data redundancy provided in RAID 1.
- Disk arrays operated in combination of striping and mirroring.

2.1.4 INSTALLATION AND CONFIGURATION

- Consist two parts
 - \succ H/W installation
 - ► S/W configuration
- H/W installation described:
 - ➢ Fix an IDE controller card
 - Check setting of jumpers
 - Mount HDD into the pay
 - Connect HDD LED
 - Connect the drive to IDE

1)CONFIGURING

- HDD mounted and connected the IDE card. Apply power system, run CMOS setprogram from BIOS.
- AUTODETECT HARD DISK facility CMOS SETUP program.

2) FORMATTING

- Hard disk drive requires
 - Low-level formatting
 - High-level formatting

Low-level formatting

- Magnetically dividing disk into tracks and sectors.
- Find out drive low-level formatted or not.
- DOS FDISK program used
- FDISK program recognizes hard disk drive, the drive already low-level formatted.

High-level formatting

- Done hard disk make disk DOS compatible by writing DBR,FATs and empty root directory.
- Low-level formatting and partitioning, final step preparing hard disk drive.
- Use high-level format drive
- Already divided tracks and sectors by high level formatting procedure.
- DOS use hard disk drive to store and read files.
- The following DOS command used for formatting the hard disk: A:\>FORMAT C:/S

3) PARTITIONING

- Low-level format next step prepare hard disk drive use is partitioning the drive.
- It is basically done on operating system on same drive more than one logical drive.
- Disk partitioned the partition program FDISK writes MBR(Master Boot Record)
- In first physical sector of hard disk.

FDISK

- Used to partition hard disk drive.
- FDISK program used
- Creating: primary DOS partition
 - Extended DOS partition
 - ➢ Logical drive extended partition
- Setting : active partition
 - deleting partition
 - displaying partition
- Selecting: hard disk drive partition
- More than One hard disk drive installed

2.2 MMX-MULTIMEDIA EXTENSION

2.2.1 CD-ROM DISK

- Introduced 1982 for audio compact disc(CD)
- Later not only used for music also for data and video

<u>1) TYPES</u>

- ➢ Audio CD
- Data CD
- ➢ CD-I(Interactive)
- Photo CD
- ➢ Video CD

Audio CD

- Spiral space string holes pressed into transparent polycarbonate layer
- Reflecting aluminium layer is applied
- Space between two holes called ISLAND
 - Three sections
 - Lead in
 - Program(data)
 - ➢ Lead out
 - Rotational speed 197 and 539 revolution per minute
 - Player has buffer memory
 - Less than 50% used drive speed is increased
 - More than 50% used drive speed is decreased
 - Represent sound signals
 - Frequency CD is 44.1khz



CD ROM

Data CD

• Replacement Data CD such as floppy disk and hard disk

Advantage

- Low cast
- Large storage capacity
- Reliability etc.,

CD ROM

- CD-ROM read only medium
- Contains only one long spiral
- CD-ROM constant speed
- Increase speed of CD motor has to be adjusted

CD-I (Interface)

- 1986 introduced CD-I for purpose of multimedia system
- Audio information recorded at speed of 1.4112 megabits per second
- Video more complex than audio information.but both audio & video interact using encoded signal
- CD-I describes multimedia information such as sound,video,animation&still video

Photo-CD

- Photo's stored digitalized at high resolution, allow to view photographs &computer screen
- Photo's can be printed

Video CD

- Developed for full-motion, full screen video
 - CD are encoded to empeg-1 standard

2) READING AND WRITING OF CD

- CD recording method makes use of optical recording
- Using of light from minute semiconductor laser
- Low-melting point materials plastic can vaporised focused beam
- No disc pulses into the form of pit or no pit
- Reading dimples on disc makes use of semiconductor laser,but much lower power need not vaporise material
- Reading beam reflected the disc where no dimple exits
- Optical system allows light to travel in both directions
- From the disc surface it possible to focus reflected beam on to detector, photodiode and pick up a signal
- When beam reflected from disc no signal when the beam falls on to pit

2.2.2 CD-ROM DRIVE

- CD-ROM drive reads data on CD
- Information travels to CPU processing to make video, text or sound

1) Principle of Operation

- CD technology based upon reflecting and deflecting laser beam
- CD-ROM recording unit the device that writes data onto blank CD creating pits and ignoring lands
- Laser positioned along surface into binary spinning disc, stroking laser created

Magneto optical

- MO drive technology offers large amount of read/write storage
- MO drive uses laser to write and read an Mo disk
- Reading: MO disc similar the standard CD-ROM
- Reflecting and Deflecting laser beam
- Creating: stroking light that photo detector intercepts
- Passes: along converted into binary number
- Laser used different purpose when writing disc
- When heated, the metal particles are mobile, when not heated metal particles are stationary



CD-ROM DRIVE

2) Installation and Setup

- Check available 4 pin power connector
- Attach 4 pin power connector drive
- Mount new drive into 5 ¼ inch expansion bay

- Attach cable noting the key in connector
- Connect audio cable supplied CD drive to sound card
- Using installation floppy disk supplied CD drive run setup copy necessary driver files
- Reboot the system

2.2.3 DIGITAL VERSATILE DISC

- DVD new generation optical disc storage technology
- DVD started digital video disk but now digital versatile disc or just DVD
- High capacity CD size disc for video, multimedia games, still photos, computer data, audio application
- Replaced laser discs
- Replacing VHS video tapes, audio CD and CD-ROM with high quality video and audio
- Computer hardware compaines, movies and music studios and electronics companies support DVD technology
- DVD capability,DVD game consoles,DVD players available market
- DVD developed ten compines
- Includes SONY, Philips and Time Warner

Comparison of CD and DVD

Parameter	CD	DVD	Remarks	
Sides	1	1 OR 2		
Layers	1	1 or 2		
Capacity(GB)	0.68GB	4.7-17GB	1 GB=10	
Track pitch	1.6	0.74		
Minimum pit length	0.83	0.4	For 13 pit	
Wavelength(nm)	780	650	Of laser diode pickup	

1) DVD TECHNOLOGY

DVD Disks

- Physical characteristics of optical disks,thickness,diameter and structure are nearly identical
- DVD possesses double substrate half thickness conventional CD
- Data structure characteristics include laser wave length, track pitch and pit length
- All characteristics differ CD to DVD
- DVD has increased maximum 17GB compared 650 MB standard CD-ROM

DVD Disk Drive

- DVD player motors employed position control laser beam tracking pits and lands of spiral tracks
- Servo circuits for proper motor control
- DVD drives employ the following servo controls:
 - Focus servo
 - Tracking servo
 - \succ Feed servo
 - ➢ Spindle servo





DVD Formats

- Two categories
 - > Physical format
 - Application format

Physical format

- DVD & CD differ number key
- DVD disc consist two substrates
- It is DVD determines capacity of DVD disc

DVD Physical Disc Format

SI.NO	Format	Capacity	Layers	Sides
1.	DVD 5	4.7 GB	1	1
2.	DVD 9	8.54GB	2	1
3.	DVD 10	9.4GB	1	2
4.	DVD 18	17.08GB	2	2



INTERNAL STRUCTURE OF DVD

APPLICATION FORMAT

DVD-R

- Use organic dye technology CD-R & compatible most DVD Drives and players
- Capacity 4.7GB

DVD-RW

- Disc re-writable disc
- Capacity 4.7GB per side
- Length and rotational control of DVD-R format

DVD-RAM

- Random read-write access DVD-RAM like virtual hard disk
- Capacity 4.7GB Per side
- Uses phase change dual technology
- •

DVD Video

- Launched 1997 in USA
- Most successful of all DVD format
- Video with surround sound audio on disc same size as CD

2.2.4 SOUND BLASTER 1) BASICS OF DIGITAL SOUND

- Waves translated analog to digital number
- Process is called sampling, means the computer take samples of sound wave
- Computer measures two qualities
- Amplitude---volume of sound ,increase wave goes up/down
- Frequency---vibration rate sound wave

2) AUDIO COMPRESSION AND DECOMPRESSION

- It is applies to both video and audio
- compressed file take up less space, performs better, less data to process
- two type code
 - \rightarrow H/W dependent codec(H/W DC)
 - S/W dependent codec(S/W DC)
 - H/W DC better require additional hardware
- S/W DC do not require H/WW for compression or play back

JPEG (Joint Photographic Experts Group)

- Developed still images, JPEG compress and decompress at rates acceptable nearly full-motion video
- Uses series still image, which easier for editing

MPEG (Moving Pictures Expert Group)

- MPEG compress up to 200:1
- At high quality levels, result better, faster video that require less



SOUND BLASTER

4) INSTALLATION AND SETUP

- 1. Verify IQRs DMAs, and I/O addresses setting referring
- 2 .Inset sound card into expansion card slot
- 3. Connect CD-ROM drive to sound card
- 4. Connect speaker and micro phone
- 5. Run S/W installation program

5) MUSICAL INSTRUMENT DEVICE INTERFACE (MIDI)

- Sound different instrument for different notes sampled and digitized accuracy to store file
- Depends sampling rate number of bits used
- Sampling 44.1 Hz and using 16 bit number
- Capture and play back sounds

<u>6)</u> <u>3D AUDIO</u>

- 3D Audio sound experience that more closely matches user get real world
- Duplicate real-world sounds the sound card model 3D sound and present sounds like real-world equivalent

7) EAX

- One another standard used sound cares music console with Acoustic Enhancement(EXE)
- Provides high level studio quality audio

Features

• Bass, boost, audio clean up, karaoke, multi-band equalizer on all channels

8) MPEG AUDIO(MOTION PICTURE EXPERT GROUP)

- Standard developed for compression And decompression of video
- Store large files lesser memory space compression techniques used
- Transfer files across Internet same technique is followed
- Compressed file sent one end is decompressed at other end
- MPEG-1 and MPEG-2 two standards developed MPEG of joint ISO technical committee