Types of magnetic storage devices computer science essay

Technology, Computer

Magnetic storage devices are used to store data in magnetic medium.

In this term paper we will discuss about its types and working principle.

The main logic is that the data will secure in these storage devices and data will store quickly in these devices. In this term paper we will also discuss the future of these devices.

MAGNETIC STORAGE DEVICES

Magnetic storage and magnetic recording are terms from engineering referring to the storage of data on a magnetized medium. Magnetic storage uses different patterns of magnetization in a magnetizable material to store data and is a form of non-volatile memory. The information is accessed using one or more read/write heads. As of 2009, magnetic storage media primarily hard disks are widely used to store computer data as well as audio and video signals.

HISTORY

Before there was magnetic storage for computers, the primary storage medium was punch cards (paper cards with holes punched in to indicate character or binary data) originally invented in the 1890. Although long obsolete in computer use punch cards in various forms are still used in older voting equipment.

PUNCH CARD

The history of magnetic storage dates back to June 1949 when a group of IBM engineers and scientists began working on a new storage device. What they were working on was the first magnetic storage device for computers, and it revolutionized the industry. On May 21, 1952 IBM announced the IBM 726 Tape Unit with the IBM701 Defense Calculator, marking the transition from punched-card calculators to electronic computers.

Four years later, on September 13, 1956 a small team of IBM engineers in San Jose, California, introduced the first computer disk storage system as part of the 305 RAMAC (Random Access Method of Accounting and Control) computers.

IBM 305 RAMAC

The 305 RAMAC drive could store only 5MB of data on 50 disks each a whopping 24? in diameter. Unlike tape drives RAMAC’s recording heads could go directly to any location on a disk surface without reading all the information in between. This random accessibility had a profound effect on computer performance at the time enabling data to be stored and retrieved significantly faster than if it were on tape.

From these beginnings, the magnetic storage industry has progressed such that today you can store 500GB or more on tiny 3 1/2? drives that fit into a single computer drive bay.

IBM’s contributions to the history and development of magnetic storage are incredible. Not only did IBM invent computer magnetic tape storage as well

as the hard disk drive but it also invented the floppy drive. The first floppy drive was created in 1971.

EXAMPLES OF MAGNETIC STORAGE DEVICES

HARD DRIVE

FLOPPY DRIVE

Mini DV TAPE

DATA TAPE BACKUP

STRIPE ON THE BACK OF DEBIT. CREDIT CARD

MAGNETIC RECORDING

Magnetic recording is the method of writing data on disk.

ANALOG RECORDING

Analog recording is based on the fact that remnant magnetization of a given material depends on the magnitude of the applied field. The magnetic material is normally in the form of tape, with the tape in its blank form being initially demagnetized. When recording the tape runs at a constant speed. The writing head magnetizes the tape with current proportional to the signal. A magnetization distribution is achieved along the magnetic tape. Finally the distribution of the magnetization can be read out reproducing the original signal. The magnetic tape is typically made by embedding magnetic particles in a plastic binder on polyester film tape. The commonly used magnetic

particles are Iron oxide particles or Chromium oxide and metal particles with size of 0. 5 micrometers. Analog recording was very popular in audio and video recording. In the past 20 years, however, tape recording has been gradually replaced by digital recording.

DIGITAL RECORDING

Instead of creating a magnetization distribution in analog recording, digital recording only need two stable magnetic states, which are the +Ms and -Ms on the hysteresis loop. Examples of digital recording are floppy disks and HDDs. Digital recording is the main process nowadays and probably in the coming future.

HARD DISK DRIVE

A hard disk drive is a non-volatile storage device that stores digitally encoded data on rapidly rotating rigid (i. e. hard) platters with magnetic surfaces.

WORKING

A hard disk uses rigid rotating platters. Each platter has a planar magnetic surface on which digital data may be stored. Information is written to the disk by transmitting an electromagnetic flux through a read-write head that is very close to a magnetic material, which in turn changes its polarization due to the flux. A typical hard disk drive design consists of a central axis or spindle upon which the platters spin at a constant rotational velocity. The associated electronics control the movement of the read-write armature and

the rotation of the disk and perform reads and writes on demand from the disk controller. The sealed enclosure protects the drive internals from dust, condensation, and other sources of contamination. Contrary to popular belief, a hard disk drive does not contain a vacuum. Instead, the system relies on air pressure inside the drive to support the heads at their proper flying height while the disk is in motion.

FLOPPY DRIVE

A floppy disk is a data storage medium that is composed of a disk of thin, flexible magnetic storage medium encased in a square/rectangular plastic shell.

WORKING

The following is an overview of how a floppy disk drive writes data to a floppy disk. Reading data is very similar.

The computer program passes an instruction to the computer hardware to write a data file on a floppy disk, which is very similar to a single platter in a hard disk drive except that it is spinning much slower, with far less capacity and slower access time.

The computer hardware and the floppy-disk-drive controller start the motor in the diskette drive to spin the floppy disk. The disk has many concentric tracks on each side. Each track is divided into smaller segments called sectors, like slices of a pie.

A second motor, called a stepper motor, rotates a worm-gear shaft (a miniature version of the worm gear in a bench-top vise) in minute increments that match the spacing between tracks.

The time it takes to get to the correct track is called “ access time.” This stepping action (partial revolutions) of the stepper motor moves the read/write heads like the jaws of a bench-top vise. The floppy-disk-drive electronics know how many steps the motor has to turn to move the read/write heads to the correct track. The read/write heads stop at the track. The read head checks the prewritten address on the formatted diskette to be sure it is using the correct side of the diskette and is at the proper track. This operation is very similar to the way a record player automatically goes to a certain groove on a vinyl record.

Before the data from the program is written to the diskette, an erase coil (on the same read/write head assembly) is energized to “ clear” a wide, “ clean slate” sector prior to writing the sector data with the write head. The erased sector is wider than the written sector — this way, no signals from sectors in adjacent tracks will interfere with the sector in the track being written.

The energized write head puts data on the diskette by magnetizing minute, iron, bar-magnet particles embedded in the diskette surface, very similar to the technology used in the mag stripe on the back of a credit card. The magnetized particles have their north and south poles oriented in such a way that their pattern may be detected and read on a subsequent read operation.

The diskette stops spinning. The floppy disk drive waits for the next command.

FUTURE

Magnetoresestive Random Access Memory

A new type of magnetic storage, called Magnetoresistive Random Access Memory or MRAM, is being produced that stores data in magnetic bits based on the TMR (Tunnel Magneto resistance) effect. Its advantage is non-volatility, low power usage, and good shock robustness.

WORKING

Unlike conventional RAM chip technologies in MRAM data is not stored as electric charge or current flows, but by magnetic storage elements. The elements are formed from two ferromagnetic plates, each of which can hold a magnetic field separated by a thin insulating layer. One of the two plates is a permanent magnet set to a particular polarity the other’s field can be changed to match that of an external field to store memory. This configuration is known as a spin valve and is the simplest structure for a MRAM bit. A memory device is built from a grid of such “ cells”.

The simplest method of reading is accomplished by measuring the electrical resistance of the cell. A particular cell is (typically) selected by powering an associated transistor which switches current from a supply line through the cell to ground. Due to the magnetic tunnel effect the electrical resistance of the cell changes due to the orientation of the fields in the two plates. By

measuring the resulting current, the resistance inside any particular cell can be determined, and from this the polarity of the writable plate. Typically if the two plates have the same polarity this is considered to mean “ 1”, while if the two plates are of opposite polarity the resistance will be higher and this means “ 0”.