Pixie Dust

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Abstract

Information plays a very important role in this world and it is important to store data for future reference. It is not possible to live without relying on the stored data and the information contained in it. From very old times people have been storing and using them for future references in different formats. Now-a-days people mostly use electronic devices to store data. Electronic storage devices such as hard disks, CDs, pen-drives and external hard disks can be found in every corner of the world. Due to the massive increase of data, size of the storing device is increasing rapidly which is also believed to have some upper limits and to this problem pixie dust has provided a viable solution.

1. Introduction

1.1 Hard Disk

A hard disk drive is a device for storing and retrieving digital information, primarily computer data. It consists of one or more rigid, rapidly rotating discs coated with magnetic material and with magnetic heads arranged to write data to the surfaces and read it from them. Hard disk drives have been the dominate device for secondary storage of data in general purpose computers since the early 1960s. They have maintained this position because advances in their recording capacity, cost, reliability, and some speed have kept pace with the requirement for secondary storage.

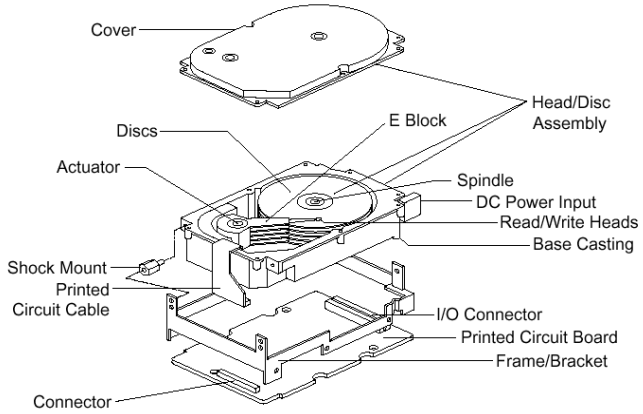

Figure 1: Sketch of a Hard Disk

1.2. Statistics

It is seen that data in the world are growing at a very large rate. 1.8 zettabytes are created in the year 2011. In 2007, 6 hours of YouTube video was uploaded every minute, but now it has been increased to 72 hours of YouTube video being uploaded every minute. It is also estimated that data is doubling every year. It is also predicted that the Internet traffic will reach 425 petabytes per month in 2016, from 40 petabytes per month in 2011. So it is really necessary that

we need more space to store the data that we are creating every year.

2. Problems

Even though there is a great advantage in present hard disk, there is upper limit of the storing capacity. But using this technology known as Antiferromagnetically-coupled (AFC) media we can get 25 Giga-byte of storage 1 square inch of area.

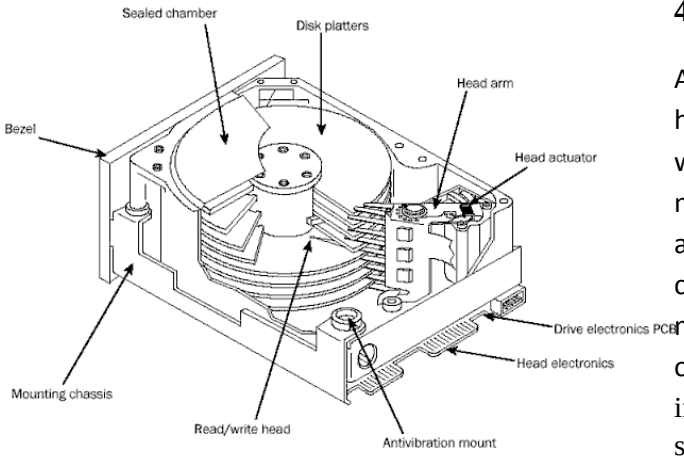

Figure 2: Working of Hard Disk

3. Existing Technology

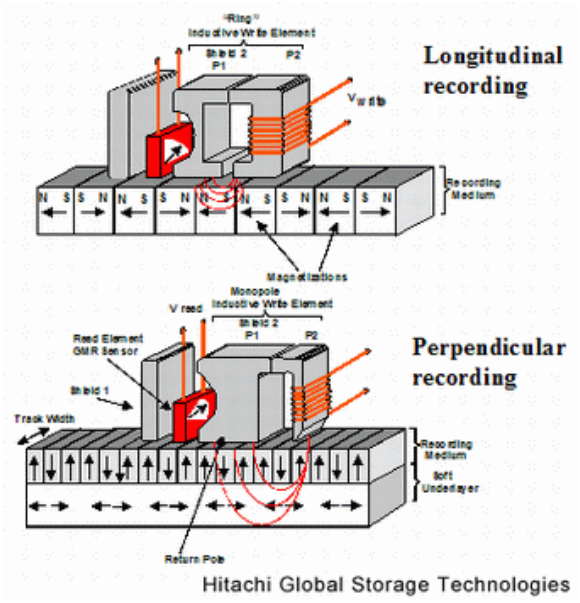

Figure 3: Perpendicular Magnetic Recording

There has been many advancements in the field of storing data and several successful solutions were found such as Perpendicular Magnetic Recording (PMR) which was able to solve the problems regarding the storage of data to certain extent. Also PMR was successful in storing large data, it also failed when it comes to the term of durability.

4. Solution

A typical HDD design consists of a spindle (that holds flat circular disks, also called platters, which hold the recorded data. The platters are made from a non-magnetic material, usually aluminum alloy, glass, or ceramic, and are coated with a shallow layer of magnetic material typically 10–20 nm in depth, with an outer layer of carbon for protection. The information is read and written by the magnetic susceptibility property of platters.

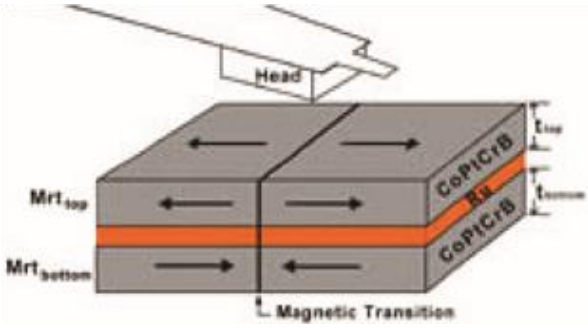

Figure 4. Pixie Dust Implementation

During course of time this gets damaged and some of the magnetic alignments in certain parts of the disc gets randomly aligned. In some magnetically soft materials the electrical resistance changes when the material is magnetized. The resistance goes back to its original value when the magnetizing field is

turned off. This is called Magneto-Resistance or the MR Effect. Giant Magneto-Resistance, or the GMR Effect, is much larger than the MR Effect and is found in specific thin film materials systems. When a read-write head passes over the bits, it either magnetically aligns the particles to record information or it reads them in order to access previously-stored data.

5. Principle

AFC media is based on adding extra energy in the form of antiferromagnetic coupling to stabilize the bits. AFC media is a multi-layer structure in which two magnetic layers are separated by an extraordinarily thin -- just three atoms thick -- layer of the nonmagnetic metal, ruthenium. This precise thickness of the ruthenium causes the magnetization in each of the magnetic layers to be coupled in opposite directions -- anti-parallel -- which constitutes antiferromagnetic coupling. The key to AFC media is the anti-parallel alignment of the two magnetic layers across each magnetic transition between two bits. As it flies over a transition, the recording head senses an effective Mrt of the composite structure (Mrteff) that is the difference in Mrt values for each of the two magnetic layers:

6. Pixie Dust

Pixie dust also technically known as "Antiferromagnetically-coupled (AFC) media," the new multilayer coating is expected to permit hard disk drives to store 100 billion bits (gigabits) of data per square inch of disk area while Current hard drives can store 20 gigabits of data per square inch. is expected to extend the lifetime of longitudinal magnetic recording technology. Afc media differ from the conventional media by their structure and functionality. Conventional recording media have one or more magnetic layers, which may be coupled ferromagnetically to each other. there are at least two magnetic layers, but the magnetic layers are coupled antiferromagnetically.

7. Advantages

AFC media is the first dramatic change in disk drive design made to avoid the high-density data decay due to the super paramagnetic effect. It has a high thermal stability. Noise reduction in AFC Media can be achieved by decreasing the anisotropy constant.

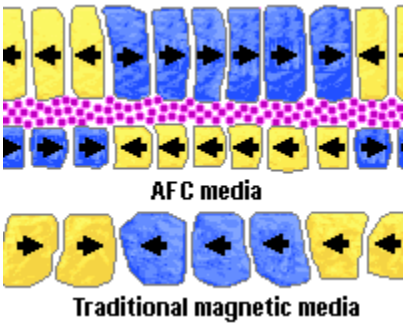

Figure 4. Pixie Dust data storage

8. Conclusion:

In summary, IBM has developed and is now mass-producing a promising new disk-drive media technology based on AFC multilayers that can enable significant areal density increases while maintaining the thermal stability of recorded data. This advancement

will permit magnetic hard-disk drive technology to extend far beyond the previously predicted "limits" imposed by the super paramagnetic effect. This technology of pixie dust will be a breakthrough in history. This app will make us step in the future with advanced data storing facilities with very long durability.

9. References

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