Case studies from classes led by Dr. Ron Fulbright, University of South Carolina Upstate.

INNOVATIVE ANALYSIS

FLASH DRIVES

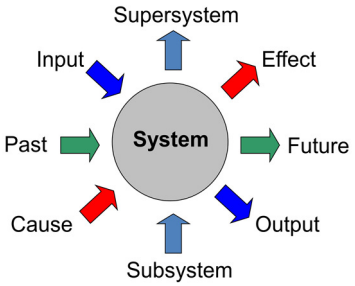
1. BRIEF DESCRIPTION OF THE SITUATION

USB Flash drives also known as memory keys, data sticks , data keys, flash disk, thumb drive, USB drive, and jump drives are ubiquitous, which simply means they are everywhere. Generally inexpensive, they hold the promise of quick and easy data backup and retrieval. They can be used to install an operating system or rescue your personal computer when it crashes. Companies use them as security keys, rendering software they sell unusable when the drive is unplugged. All of these uses are described in the context of its **primary useful function "Data Backup Mechanism"**

However, the Flash Drive has several problems.

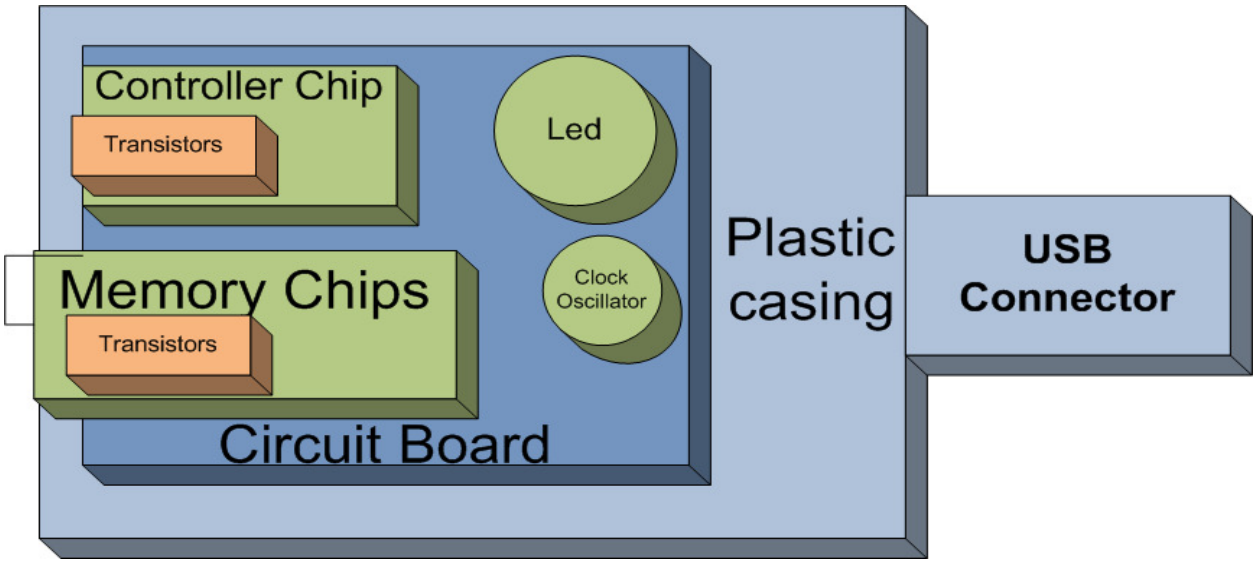
- They are easily misplaced.
- They degrade over time and become slow.
- They only connect to USB ports.
- All of the above cause the primary problem which is **Loss of Critical Files or simply Data Loss.**

2. DETAILED DESCRIPTION OF THE SITUATION



We are living in the computer age. There is no disputing that fact. Computers consume, rearrange and produce data. Data that has to be stored retrieved, printed, changed, and transported. Flash drives represent the market's current answer for convenient data access as we find ourselves now in the fall of 2010. The analysis contained within these pages represents the effort of this group to identify and improve the characteristics in flash drives that will have the most impact on the ideality of the system (flash drives).

2.1 SUPERSYTEM/SUBSYSTEM ANALYSIS



Listing (not in order - see diagram for how these parts relate)

Plastic casing

Light Emitting Diode

Circuit Board

Memory Chips

Transistors

Controller chip

Clock Oscillator

Circuit (board traces)

Resistors

Capacitors

Connector

Cover/Slider

2.2 INPUT/OUTPUT ANALYSIS

Input	Output
1.Data (music/documents/pictures/music)	Data (music/documents/pictures/music)
2.PC Rescue Software	Restored PC
3.Operating System Install	Freshly imaged PC with Operating System on it.
4.Other software install	PC with new software on it

2.3 CAUSE/EFFECT ANALYSIS

Cause	Effect
1. Need to store information.	Use computer to write to flash drive.
2. Need to retrieve information.	Use computer to read from flash drive.
3. Need to transfer information.	Do 1 and 2 above with a combination of taking the drive from one place to another.

2.4 PAST/FUTURE ANALYSIS

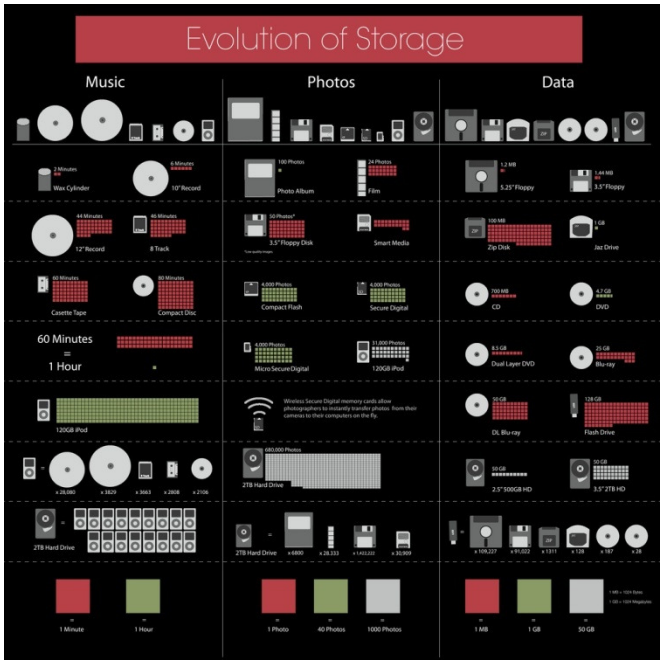
It is a relatively new invention that appeared on the market in approximately the year 2000 (Wikipedia article on flash drives) . Their memory capacity continues to rise while their prices keep dropping. Today a 64 Gigabyte flash drive is not unheard of and smaller drives can be

bought for less than what a stack of blank CD's might cost. Synonyms for this bit of technology is rather lengthy, these are the notable ones: memory key, data stick , data key, flash drive, flash disk, thumb drive, USB drive, and jump drive. They have taken the form of wristwatches, teddy bears, refrigerator magnets, and pens among other things. A Google image search for flash drives will currently return a colorful example of the many physical forms, and a screen shot of this initial image search was used as the title slide in the PowerPoint presentation for this project. It is possible that no form of data storage has been as diverse in its appearance up to this point.

(Click here for image source)

Source Notes: The following image was found in a Google image search for “History of Digital Storage”

This image displays an interesting look at digital storage over the last couple of decades. Trends include faster access and larger and larger data sizes, along with falling prices (measured in dollars / (kilo/mega/giga/tera)-byte).



3. RESOURCES, CONSTRAINTS, AND LIMITATIONS

3.1 AVAILABLE RESOURCES

Resource Listing:

Plastic casing

Light Emitting Diode

Circuit Board

Memory Chips

Transistors

Controller chip

Clock Oscillator

Circuit (board traces)

Resistors

Capacitors

Connector

Cover/Slider

3.2 ALLOWABLE CHANGES TO THE SYSTEM

Any changes not allowed would fall into the following categories:

1) Changes that negatively impact the primary useful function (data backup and retrieval in a convenient manner. An example would be increasing the physical size to the point where carrying the device becomes a problem.

2) Any change that makes the device unmarketable to the economic market.

3.3 CONSTRAINTS AND LIMITATIONS

Size: flash drives are appreciated for compact size, but at the same time they can be easily left behind or misplaced. Drive must hold a significant amount of data (at least a few gigabytes)

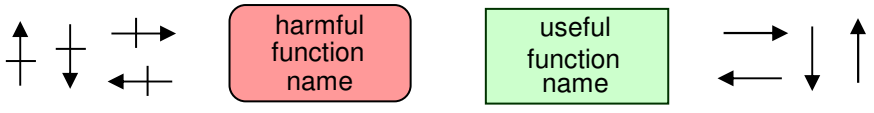
Life span: The life span of flash memory device is measured in number of write and erases cycles. Average life duration of a flash drive (under normal conditions) is about several hundred thousand cycles. As the device ages, the speed of writing process gradually slows. This is an issue of a special matter in some cases (example: running application software or an operating system).

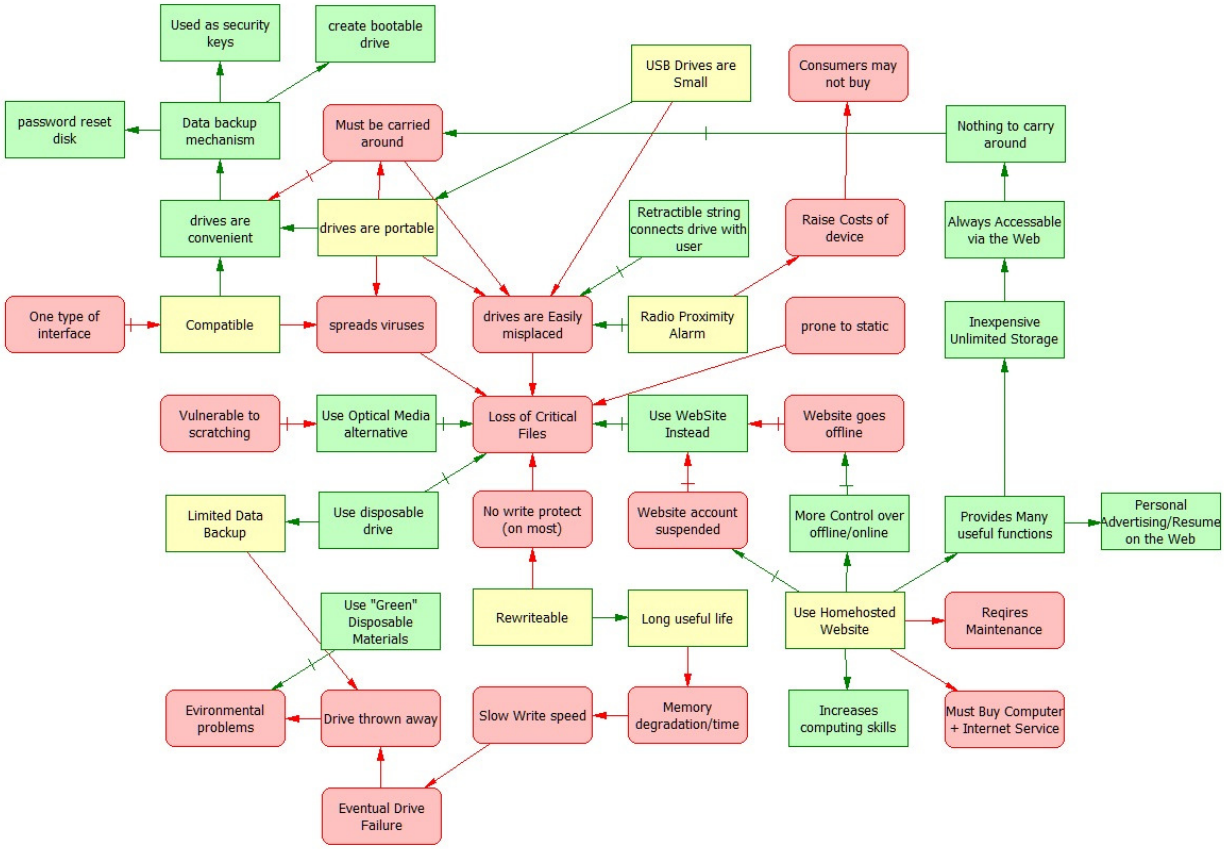
Write-protection: Only a few flash drives are equipped with a write-protect mechanism. It usually features a switch on the driver's housing. This feature makes it possible to use the flash drive for repairing virus-contaminated PCs without infecting the flash device itself. It is preferable, therefore, to include this feature always, rather than sometimes as it is found.

Price: Cost must remain in market range.

Weight/Size: Drive must be portable, might have to be small in size.

4. PROBLEM FORMULATION




Used as security keys
create bootable drive
USB Drives are Small
Consumers may not buy
password reset disk
Data backup mechanism
Must be carried around
Nothing to carry around
drives are convenient
drives are portable
Retractible string connects drive with user
Raise Costs of device
Always Accessable via the Web
One type of interface
Compatible
spreads viruses
drives are Easily misplaced
Radio Proximity Alarm
prone to static
Inexpensive Unlimited Storage
Vulnerable to scratching
Use Optical Media alternative
Loss of Critical Files
Use WebSite Instead
Website goes offline
Limited Data Backup
Use disposable drive
No write protect (on most)
Website account suspended
More Control over offline/online
Provides Many useful functions
Personal Advertising/Resume on the Web
Use "Green" Disposable Materials
Rewriteable
Long useful life
Use Homehosted Website
Reqires Maintenance
Evironmental problems
Drive thrown away
Slow Write speed
Memory degradation/time
Increases computing skills
Must Buy Computer + Internet Service
Eventual Drive Failure

5. IDEAS

IDEA: Completely remove the object that gets lost (source, i.e.: the flash drive)

Eliminate the cause of an undesired action

To exclude the cause of an undesired action, consider the following recommendations (Operators): Eliminate the source of an undesired action (losing the drive) Use an alternative which may and does introduce its own set of desired and undesired characteristics.

IDEA: Use an inexpensive retractable zip string to connect the drive with the user.

Use inexpensive, disposable objects to improve reliability (specialized operators)

IDEA: Use an inexpensive disposable flash drive.

This idea was a result of examining the 40 Innovation Principles of I-TRIZ, specifically :

27. Disposable object

This is also an application of the Alternative group of operators – Enhance useful parameters by using an inexpensive object.

(Replace an expensive object by a collection of inexpensive ones, forgoing properties e.g. longevity)

Then it will not matter as much if you lose it provided it is cheap and disposable.

IDEA: Consider a device that will carry and synchronize data across multiple flash drives, a dock of sorts. This idea was generated during the presentation (Thanks Dr. Fulbright!)

(Specific Operator unknown – possibly involving alternatives or modification of an available resource)

Many more ideas can be gained by examining the PF-diagram, most deal with the many alternatives available that fill the data backup/storage/retrieval role.