Green Computing: A New Vision to Computer Technology

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Abstract— *The usage of computer in day to day affairs is a basic need of everyone. No individual or organization can work without computer in the present era. However, extravagant practice of involving computer technology demands certain degree of responsibility on the part of user to avoid or minimize associated harmful impacts that are badly affecting environment.*

Information and communications technology (ICT) infrastructure accounts for seemingly significant electricity usage and considered accountable for greenhouse gases (GHGs) globally. The overwhelming and improper usage of ICT is leading to continual increase in carbon foot printing and GHGs. Green computing is emerging as a prompting solution to this crisis. Foremost measure in this regard is to develop computing technology that cut down usage of power input thus may leads to significant reduction in CO_2 emission. Various proposed measures taken in this regard can be considered as effective approach to protect our environment from the hazardous material and its effects specially computers and related devices. We also highlighted computing related distresses, possible steps for its minimization through Green computing. The article also covers prospective measures ought to be taken to reduce the associated harmful impacts on our environment thereby protect planet from any future disaster.

Keywords— *Green computing, ICT, GHGs.*

I.   INTRODUCTION

Green use of resources in computing and IT/IS infrastructure emphasises in reducing environmental hazards without compromising economic viability and system performance. In general, "green technology" implicates broad spectrum of subject that mainly deals with alternative energy-generation and electricity consumption. It also uses eco-friendly, recyclable materials for implementing sustainable digital services. Green technology in fact is a misnomer and has less correlation with usage of plants based material as such. In fact, it entails green infrastructure (energy-efficient buildings, intelligent cooling systems, renewable power sources), green hardware (multicore computing systems, energy efficient server design and solid-state storage and green software and applications) in parallel to computational science algorithms to run modern energy efficient multi-core clusters, intelligent load distribution and CPU switch-off *etc*.

II.   GREEN COMPUTING A GLOBAL NEED

Green computing as such is an attempt to reduce or minimise usage of hazardous material in development of computer based programs. This circumvents safety and protection of environment from ill effect of various computer related activities. Green computing implies manufacturing, usage and disposing of computers with no untoward impact on environment. It also helps to reduce carbon foot print generated by the computer as well as information technology related business avenues that are generally employed for economic perspectives. There should be minimal use of information as well communication technology in context of computation of various activities to reduce their negative impact on the environment. The concept itself has great impact to safeguard and protect environment. In general, the functioning of computer requires electricity. Constant supply of electricity required for computer running causes extensive CO_2 emission. There is a need to inform computer user to save electricity in order to save environment. PCs and data centres also contribute significantly in consumption of lot of energy relying on old practicing techniques which do not have sufficient cooling systems. Computer networking devices produce huge amount of CO_2 emission, however, a great part of CO_2 emission is contributed from PCs and their peripherals. In general various components of Computer system are not bio gradable and are seldom recycled. Defects in manufacturing techniques, packaging, disposal of computers and components may also contribute significantly in environment pollution. Toxic chemicals used in the manufacturing of computers may spill during informal disposing and exert harmful impacts on our environment. The user should be taught to save environment by minimising harmful impacts of computers. In nutshell to decrease computer mediated environment pollution, the term green computing comes into existence. There are various reasons for the use of green computing viz.

- Computers and electronic devices consume a lot of electricity posing harmful impact on our environment. It may result in air, land and water pollution. Electricity generated through Fossil Fuel power plants release air pollutants

and consumes a lot of water that may affect our environment like climate change, acid rain (pH<5), ozone(O_3) and air toxic.

- Electronic devices generate a lot of heat which cause the emission of CO_2, a major component of green house gases, and contribute in warming by reducing outward radiation. With rapid increase in CO_2 production the rate of global warming increases and cause climate change.

- Disposing of computers and it components produce lot of hazardous waste that may damage our environment. It also results in release heavy metal like lead (Pb), mercury (Hg), cadmium (Cd) into air.

- The usage of toxic chemical for electrical insulation, soldering, and fire protection may also pose a threat to environment. Exposure with chemical fumes over the long term can cause cancer, miscarriages and respiration related discomforts. There should be minimal usage of electrical devices to save our environment from associated harmful impacts.

III.   PRESENT SCENARIO

Every single facet of our day-to-day life involving home, workplace, hospitals, industries etc., connected in some way or other to the computer. Today, we can 'see' and contact with our colleagues, family and friends from across the world with a set of PC and a webcam. The computerised operations of various activities involving complex calculations, office work, online billing, online shopping, and online games etc. has become essential component of any functional organisation. The computer usage facilitates time and input depended work functioning; however it is full of negative effects as well .Computer hardware is consisting of hazardous elements like silicon, germanium, etc. These elements & other chemical components of the hardware may contribute in global warming thus impact environment. The browsing employing internet is also causing increase in CO_2 (carbon dioxide) emission which leads to global warming. Over exposure with computer may also result in diseases such as cancer, bone deformity, kidney and vision related diseases etc. The search engine contributes to carbon emission of the value of approximately 7g each day thus heavily impacting our environment. It has been recently estimated that Search Engine emits 0.2g for single search, YouTube emits 1g for every 10 minutes video watched, and Gmail emits 1.2g per year for one user only. The annual energy consumption of computers varies widely, from under 30 kilowatt-hours (kWh) for a rarely used laptop to over 1,000 kWh for a large desktop that uses several peripheral technologies and is often kept on day and night. While the computer itself usually accounts for the largest share of energy use, the monitor, speakers, printer, modem, router, scanner, and other accessories also consume significant amounts of electricity as well (**Table 1**).

TABLE1
ANNUAL POWERS DRAW OF COMPUTERS AND MONITORS
Representative power draw values for desktop PCs, laptops and LCD and CRT monitors are shown here

	Energy Star maximum allowable power draws (watts)		
Pc types	Idle	Sleep	Standby
Desktop	50	40	2
Laptop	22	17	1
CRT monitors	Active	Sleep	off
15 in	63	4	1
17 in	74	4	1
19 in	107	4	1
20 in	140	3	1
LCD monitors	Active	Sleep	off
15 in	23	2	1
17 in or larger	28 Megapixel	2	1

E Source: data from US, EPA and DOE

IV.   A POSSIBLE SOLUTION

Inspite of various harmful impacts posed by computers, we cannot think of any routine activity without computers. Recommendation to stop using computers or as a matter of fact a no to electric power does not seem to fit into scheme of the things, rather it should be their usage in intelligent fashion. The following actions could be recommended for a balancing act.

1. **Upgrade desktop versions to Energy Star–rated computers**

The energy saving (star labelled) products should be recommended to make them compatible with concept of Green Computing. The products should have less power consumption features. The devices should be programmed to a low power state when not in use. It is mandatory to have "Energy Star" labelled desktops, monitors, laptops, printers and other computing devices.

2. **Turn off PC when not in use**

In general, PC's and its peripherals consume more power thereby result in emission of high amount of CO_2. It is recommended to opt for sleep mode option rather to switch off the system.

3. **Sleep Mode**

Sleep mode saves session and put computer in a low power state so that one can quickly resume windows. It can save 60-70 percent of electricity.

4. **Hibernation**

This mode allows shut down of the system when not using computer for a short period of time. It saves the electricity when computer is not in use.

5. **Screen saver a big NO**

Screen saver can be a graphic, text or an image that appears on computer screen when it is not in use for pre-set time. Screen savers also consume electricity even when a computer is not in use. The best option to save energy is to turn off monitor instead of using screen saver.

6. **Turning down monitor brightness**

Electricity consumption plays a main role in CO_2 emission. Full brightness of PC screen requires more power input as compared to relatively normal brightness. It is recommended not to use PC with high brightness.

7. **Stop informal Disposing**

The hardware of PC is consisting of toxic chemical substances. The disposal of non functional computer hardware components should be done in more intelligent and environment friendly manner.

8. **Preferred usage of Light Emitting Diode (LED) over Liquid Cristal Display (LCD) monitors**

Light Emitting Diode (LED) is less power consuming, while Liquid Cristal Display (LCD) monitors are likely to emit more CO_2 that ensues in global warming.

9. **Hardware recycling using formal techniques**

10. It is advisable to recycle various hardware components of old computer systems thereby minimizing computer related hazards.

V.   CONCLUSION

Keeping into consideration computer related environment hazards such as usage of electricity, excess CO_2 production leading to global warming. It is recommended that we should avoid over usage of computers. We should also opt for measures that may facilitates less energy consumption as well as CO_2 emission thereby may help in minimising environment hazards. It is recommended to imply green computing that may help to avoid:

1. Excess electric power consumption

2. Less CO_2 emission

3. Less increase in environment temperature

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