

IMPLEMENTING GREEN COMPUTING IN COLLEGES BY RECYCLING E- WASTAGES

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Abstract

The main objective of Green Computing is to achieve economic feasibility and improve the way the computing devices are used. An excellent green computing practice involves developing eco-friendly environments, energy-efficient computers, and improved disposal and recycling procedures. It also implies reducing the usage of unsafe materials, maximizing the output by minimizing energy consumption, and recycling used materials. This paper aims to provide a study on the role of green computing, which can be implemented in colleges by recycling IT – wastes.

Keywords: Green Computing, Recycling, Computers

I. INTRODUCTION

What is Green Computing?

Green computing is the environmentally responsible and eco-friendly use of computers and their resources. The main idea behind green computing is “reduce, reuse, recycle.” Economic logic has energy efficiency and saves the total cost of ownership, which includes the cost of disposal and recycling. Green Computing is also called green information technology (Green IT). Nowadays, many IT manufacturing companies and vendors are endlessly capitalizing on designing energy-efficient computing devices, aiming to reduce the use of dangerous materials and reassuring the recyclability of digital devices. The practice of green computing came into existence in the year 1992 when the Environmental Protection Agency (EPA) launched the Energy Star Process [1].

To promote green computing, four main approaches can be followed, namely

- **Green use:** The consumption of electricity in computers and other electronic devices can be minimized
- **Green Disposal:** Appropriately dispose of the unwanted electronic equipment.
- **Green Design:** Design energy-efficient computers and other electronic gadgets.
- **Green Manufacturing:** While manufacturing computers, minimize wastages.

Why is Green Computing Important?

If they do not reduce the rate and amount of toxic waste, the earth may no longer sustain the living environment [2]. By reducing the usage of energy from green techniques, it lowers carbon dioxide emissions. To put it in simple words, it lowers the cost for the resources and saves energy.

Green technology can be applied on both major and minor scales. Unfortunately, several concerns and business owners are hindered by the preliminary investment in green technology and fail to recognize the long-term benefits and cost savings.

Merits of Green Computing

- **Saving Energy:** By using green computing, positively impacts using less quantity of energy. It is essential to decrease the usage of energy in the IT processes.
- **Saving the Cost:** By implementing green computing, it helps people to save the cost.
- **Recycling Process:** Green computing encourages to implementation of reusing and utilization of electronic wastes. The electronic elements can be recycled to provide an eco-friendly environment.

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- **Less Pollution:** Various pollution problems can be avoided by implementing green computing. For example, if the electronic wastes are not properly recycled, it can lead to soil pollution. By using the green computing process, proper recycling techniques can be done, and the impact created by the pollution can be minimized.

Individual Green Computing

Numerous practices can be applied to personal computers. For example, power management can be easily activated in computers, which leads to active means of saving green while saving energy. Though many operating systems come with power-saving options, numerous products monitor and regulate the energy levels automatically, which helps to improve performance and reduce energy waste. The hibernate or sleep mode can be used when away from a computer for a certain period. Instead of purchasing a typical computer, the users can buy energy-efficient computers. The computers can be turned off at the end of every day. Refill the printer cartridges rather than buying a new cartridge. Despite buying a new computer, try refurbishing an existing device.

II. CURRENT METHODS OF SAVING ENERGY

Currently, many new methods are followed to save energy in systems. Algorithmic efficiency directly affects the number of resources, which is required for running a computing function. For instance, using hashing or indexing techniques instead of linear-based search can result in faster processes, reducing resource usage and proper resource allocation.

Another critical method that helps in implementing green computing is virtualization. With virtualization, a system administrator can associate various physical devices into virtual machines on one single, powerful system, thereby unplugging the original hardware and can minimize the power and cooling consumption.

Many commercial companies offer software packages to permit a transition to virtual computing. Intel Corporation and AMD have assembled proprietary virtualization to the x86 instruction set into each of their CPU products to enable virtualized computing.

Terminal servers can be used in green computing methods. Using this method, the user's terminal is attached to a central server. All the processing is performed at the server level, but the end-user experiences the operating system. The usage of terminal services with thin clients to create virtual labs has been increased. About 1/8 the amount of energy is used in the thin clients for a standard workstation. With the help of thin clients and terminal servers, it can deliver the windows or Mac operating system to the end-users. It could also decrease energy costs and consumption.

The power management technique can be used, which helps in improving energy efficiency. The Advanced Configuration and Power Interface (ACPI) is an open industry standard, allowing an operating system to control the power-saving aspects directly. The computer screens and other hardware can be automatically turned off. In addition to it, a system may hibernate, and the CPU, system RAM are turned off.

III. SURVEY ON GREEN COMPUTING

Many researchers have presented their study on Green Computing by exploring the development of efficient computer programs. According to their idea, using all the available cores of a CPU results in faster execution than any single-core implementation of the program, which further results in energy savings.

Pahlevan et al. [3] presented an optimization framework for managing green data centres using multilevel energy reduction techniques jointly. Mesaad et al. [4] surveyed the current green computing initiatives and an overall

comparison to show their efficiency. HP program is the greenest computing waste-management initiative from the point of E-waste management.

More et al. [5] surveyed various techniques, models, algorithms for energy-intelligent green cloud computing. The primary technique used is virtualization. The study mainly includes the consolidation of virtual machines (VMs). By deactivating and reactivating the physical machines, the power consumption can be decreased.

Many researchers are working on it in different ways to achieve the goal. The most widespread method is the virtualization and cloud computing. Virtualization gives way towards green by providing virtualization software and management software. Both virtualization and green solutions can be easily implemented if the users understand the hardware base. Another major latest trend is cloud computing. The virtual servers play a vital role in it. Cloud computing is an energy-efficient tool for ICT. It provides improved resource utilization, which is suitable for the development of green technology [6].

IV. E-WASTE

The Economic Co-operation and Development (OECD) outlines electronic waste as any device powered by electrical energy that has reached the end of its working life. Some of the waste electrical, electronic equipment are

- Refrigerators and other cooling devices.
- Computers and telecommunications devices.
- Mobile devices, batteries
- TV, monitors, circuit boards, and screens
- LED bulbs
- Electronic cookers, DVDs, fans, micro-ovens

E-waste Recycling

Most electronic devices contain toxic chemicals and hazardous materials. Furthermore, when these are not correctly disposed of, they can be the root source for releasing toxic substances into our environment. E-Waste recycling is specified to the reprocessing and reuse of these electronic wastes. It is a simple process that seeks to recover material from electronic waste. This way, it helps to build new electronic products. Recycling of E-waste is a fast trending one, and it was started to safeguard human and environmental health.

Components that can Be recycled

Some of the components that can be recycled are metal, glass, mercury, circuit board, hard disk, toner and ink cartridges, batteries, and speakers. By recycling E-waste, it aids in recovering valuable materials from electronic products that are no longer needed or old. This, in turn, saves and conserves natural resources.

V. FOCUS OF GREEN IT

According to many researchers in the earlier period, their primary attention was on computing efficiency and cost related to IT equipment and infrastructure services. However, presently, the infrastructure is becoming a bottleneck in the IT fields. The cause for this change is due to the increasing computing needs, energy cost, and global warming. Today the researchers are concentrating on the cooling system, power, and data center space.

VI. IMPLEMENTING GREEN INITIATIVES IN COLLEGES

Nowadays, many colleges are trying to initiate green IT on campus. Colleges have the responsibility to instill a green lifestyle in young minds [7]. In most colleges, many eco-friendly projects and campaigns are initiated on the campus. Solar panels can be used in buildings.

Presently, the world is now digitally focused on all things. The colleges can be equipped with computer classes, electronic libraries, and online testing programs. Electronic notes can be given by avoiding paper and money on purchasing notebooks.

Any needs to have some green mission ideas for college students could involve the students in perceptible activities towards protecting the environment. Cars and bikes are the chief reasons for pollution in the air. Insisting the students use bicycles at least two days per week could help control the air pollution. Many colleges provide carpool boards that allow pairing riders with drivers and shuttle buses to run on biodiesel.

VII. CONCLUSION

Moving into “green” in computing could help provide an eco-friendly and cleaner environment. Most organizations, colleges, and universities are working towards the execution of green computing platforms. More awareness should be increased among the people regarding green computing, giving a more significant impact in the upcoming future.

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