Schematic Classification Model of Green Computing Approaches

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ABSTRACT

Every electronic device has an impact on the environment, and computing devices are not an exception. Green computing is a highly motivated smart computing which tries to save energy and environment by minimizing harmful impacts of computing resource's production and their uses. As the 21st Century is known for Information Technology Revolution, major negative impact of computing resources on environment are day by days increasing contribution to carbon dioxide emission, hazardous substances, e-Waste and high consumption of energy. Nowadays Global Warming is a big issue which is responsible for climate changes. And according to many available facts computing resources are highly affecting it directly and indirectly. So the world's moral duties motivate it to save earth and environment from these harmful impacts, whose outcome is Green Computing. This paper focus on classification of various existing approaches which are used for Green Computing. This classification enhances researcher's concentration on particular classified category for their future contribution so that Green Computing's main aims can be fulfilled.

Keywords: Carbon Dioxide Emission, E-Green Policies, E-Waste, Green-HCI, Green Behavior, Green Computing, Global Warming, Hazardous Substances

1. INTRODUCTION

Humans are the major cause of global warming as per The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) which states: "It is a greater than a 90 per-cent certainty that emissions of heat-trapping gases (greenhouse gases) from human activities have caused most of the observed increase in globally averaged temperatures since the mid-20th century." We all know that warming and cooling has happened in the past and long before human was around. Many factors (called "climate drivers") can influence Earth's climate such as changes in the sun's intensity and volcanic eruptions, as well as heat-trapping gases in the atmosphere (Website 18). Among such all types of human activities, one major activity is con-cern to computing resources. 21st Century is known for Information Technology revolution, so by using intelligence power, human beings are continuously involved in developing and using computing resources. A study states that both production and use of IT-equipment are energy

consumptive, and this accounts for 2% of total carbon emissions (Dookhitram et. al., 2012). As a part of human being community our moral duties motivate us to minimize such types of our activities that causes of global warming so that we can restore damaged ecosystems. Apart from global warming issue, another issue is human health, in today's information and communication revolution scenario many health problems arises due to direct and indirect utilization of computing resources. By keeping all of these points in mind researchers take action to save earth, environment and health from harmful impacts of production and use of computing resources, whose consequence is evolution of Green Computing.

2. OVERVIEW OF GREEN COMPUTING

The Energy star was launched by the U.S. Environmental Protection Agency, which was a voluntary labeling program which indicated the energy efficiency of a device. The term "green computing" was coined immediately after the Energy Star program began (Nagaraju, 2013).

Much research on computing shows that carbon-dioxide (and other components of greenhouse gases) emissions are causes of environmental damage (Global Warming). Preserving environment is a legitimate goal because environment and earth planet is beautiful and intriguing—a life-giving planet. Research is going on how to minimize e-waste and use of non-toxic materials in production of e-equipment with idea of increasingly energy efficiency of resources and recycling of products (Soomro & Sarwar, 2012). Here I would like to attract researchers' concentration on human health issue also. There is need to develop such type of computing resources which takes care about earth, environment and human health.

3. COMPUTER RESOURCE UTILIZATION AND CARBON EMISSION

A report on "The Energy Consumption and Carbon Footprint of ICT Usage in Australia in 2010" states that ICT is responsible for near about 2.7% of Australia's total carbon emissions. And it is directly responsible for more than 7% of all electricity generated in Australia (Nagaraju, 2013).

As shown in Figure 1, major contribution to ICT carbon emissions are Data Centre Environment (18.8%), PCs (15.8%), Printers and Imaging Equipment (15.7%) and Servers (14.7%) (Philipson, 2010)

4. NEED TO STUDY CLASSIFIED GREEN COMPUTING APPROACHES

ICT industry forms a complex group of hardware, software, networks and its users so there must be systematic classification for green computing approaches which address increasingly to sophisticated problems. As indicated in (Nagaraju, 2013) the green computing initiative must features such as Product Longevity, Software and Deployment Optimization, Algorithmic Efficiency amongst other features.

A systematic classification model has been proposed in Section 5 which is comprehensive in nature for future study and involves all major areas of green computing.

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