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Technological Innovations among the Generations of Computer

Naresh Kumar Sharma
Faculity Member Department of Computer Sciences: Govt. Degree college Dudu Basantgarh Udhampur J&K

Abstract: ***The swift advancement of science and technology brings about significant transformations across various domains of life and work. In this context, computers have integrated into every facet of existence, including the economy, education, leisure, and family life. Given that children today are often exposed to knowledge prior to reaching school age, it raises the question of how to adequately prepare them for the contemporary world, which is markedly different from the environment in which previous generations were raised. Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. Nowadays, generation includes both hardware and software, which together make up an entire computer system. There are five computer generations known till date.***

Keyword: Technology, Innovation, Computer, Generations, Hardware, Software AI, etc.

I. INTRODUCTION

The word ‘computer’ is an old word that has changed its meaning several times in the last few centuries. Originating from the Latin, by the mid-17th century it meant ‘someone who computes’. The American Heritage Dictionary (1980) gives its first computer definition as “a person who computes.” The computer remained associated with human activity until about the middle of the 20th century when it became applied to “a programmable electronic device that can store, retrieve, and process data” as Webster’s Dictionary (1980) defines it. Today, the word computer refers to computing devices, whether or not they are electronic, programmable, or capable of ‘storing and retrieving’ data. The Techencyclopedia (2003) defines computer as “a general purpose machine that processes data according to a set of instructions that are stored internally either temporarily or permanently.” The computer and all equipment attached to it are called hardware. The instructions that tell it what to do are called "software" or “program”. A program is a detailed set of humanly prepared instructions that directs the computer to function in specific ways. Furthermore, the Encyclopedia Britannica (2003) defines computers as “the contribution of major individuals, machines, and ideas to the development of computing.” This implies that the computer is a system. A system is a group of computer components that work together as a unit to perform a common objective. The term ‘history’ means past events. The encyclopedia Britannica (2003) defines it as “the discipline that studies the chronological record of events (as affecting a nation or people), based on a critical examination of source materials and usually presenting an explanation of their causes.” The Oxford Advanced Learner’s Dictionary (1995) simply defines history as “the study of past events. In discussing the history of computers, chronological record of events – particularly in the area of technological development – will be explained. History of computer in the area of technological development is being considered because it is usually the technological advancement in computers that brings about economic and social advancement. A faster computer brings about faster operation and that in turn causes an economic development. This paper will discuss classes of computers, computer evolution and highlight some roles played by individuals in these developments.

II. COMPUTER FUNCTIONS

The following are the four main functions that a computer performs, which constitute the reasons for the existence of this device and how it works:

1) Data Input: It is the first function a computer performs, during which data is entered into the computer through various input devices; such as keyboard, mouse, and other input devices, and the process of entering data can be completed automatically through what is known as automating source data, through which special tools are used to collect data automatically, and then send it directly to the computer.

2) Data Processing: It is the main function that the computer performs, during which raw data entered is processed in order to convert it into information to be used by its user, and this function is done by the central processing unit (CPU) and random access memory (RAM).

3) Data Output: It is the process by which the processed data is extracted and converted into useful information for the user, and this information is extracted through the output devices available through the computer; such as paper printer, speaker devices, screen, and other types of output devices.
4) Data and Information Storage: It is the fourth and final function of the computer, as data and information are processed via computer memory and saved on a storage unit known as the hard disk to be usable at any time, and such data and information can also be saved via external storage tools; such as optical disks.

III. TECHNOLOGICAL INNOVATION IN GENERATION OF COMPUTERS

A. *Technology In 1st Generation*

First generation computers were vacuum tubes/thermionic valve-based machines. These computers used vacuum tubes for circuitry and magnetic drums for memory. A magnetic drum is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored. Input was based on punched cards and paper tape and output was displayed in the form of printouts. First generation computers relied on binary-coded language (language of 0s and 1s) to perform operations and were able to solve only one problem at a time. Each machine was fed with different binary codes and hence were difficult to program. This resulted in lack of versatility and speed. In addition, to run on different types of computers, instructions must be rewritten or recompiled.

B. *Technology in 2nd Generation*

Second generation computers used transistors, which were superior to vacuum tubes. Since transistor is a small device, the physical size of computers was greatly reduced. Computers became smaller, faster, cheaper, energy-efficient and more reliable than their predecessors. In second generation computers, magnetic cores were used as primary memory and magnetic disks as secondary storage devices. However, they still relied on punched cards for input and printouts for output. One of the major developments of this generation includes the progress from machine language to assembly language.

C. *Technology in 3rd Generation*

The development of the integrated circuit was the trait of the third generation computers. Also called an IC, an integrated circuit consists of a single chip (usually silicon) with many components such as transistors and resistors fabricated on it. Integrated circuits replaced several individually wired transistors. This development made computers smaller in size, reliable, and efficient. Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with operating system. This allowed the device to run many different applications at one time with a central program that monitored the memory. For the first time, computers became accessible to mass audience because they were smaller and cheaper than their predecessors.

D. *Technology in 4th Generation*

The fourth generation is an extension of third generation technology. Although, the technology of this generation was still based on the integrated circuit, these have been made readily available to us because of the development of the microprocessor (circuits containing millions of transistors). The fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to the personal computer (PC) revolution. This generation also saw the development of the GUIs (Graphical User Interfaces), mouse, and handheld devices. Despite many advantages, this generation required complex and sophisticated technology for the manufacturing of CPU and other components.

E. *Technology in 5th Generation*

The dream of creating a human-like computer that would be capable of reasoning and reaching a decision through a series of "what-if-then" analyses has existed since the beginning of computer technology. Such a computer would learn from its mistakes and possess the skill of experts. These are the objectives for creating the fifth generation of computers. The starting point for the fifth generation of computers has been set in the early 1990s. The process of developing fifth generation of computers is still in the development stage. However, the expert system concept is already in use. The expert system is defined as a computer information system that attempts to mimic the thought process and reasoning of experts in specific areas. Three characteristics can be identified with the fifth generation computers, which are:

1) Mega Chips: Fifth generation computers will use Super Large Scale Integrated (SLSI) chips, which will result in the production of microprocessor having millions of electronic components on a single chip. In order to store instructions and information,

fifth generation computers require a great amount of storage capacity. Mega chips may enable the computer to approximate the memory capacity of the human mind.

2) Parallel Processing: Most computers today access and execute only one instruction at a time. This is called serial processing. However, a computer using parallel processing accesses several instructions at once and works on them at the same time through the use of multiple central processing units.

3) Artificial Intelligence (AI): It refers to a series of related technologies that tries to simulate and reproduce human behaviour, including thinking, speaking and reasoning. AI comprises a group of related technologies: expert systems (ES), natural language processing (NLP), speech recognition, vision recognition, and robotics.

IV. CONCLUSION

The technological innovation of computers' denotes the progression of computing technology through various phases, each defined by notable advancements and technological transformations. Each phase is distinguished by its main electronic component, resulting in enhancements in dimensions, speed, dependability, and functionalities. The pivotal technological breakthroughs that facilitate these generational transitions encompass the shift from vacuum tubes to transistors, followed by integrated circuits, microprocessors, and ultimately, the emphasis on artificial intelligence and quantum computing.

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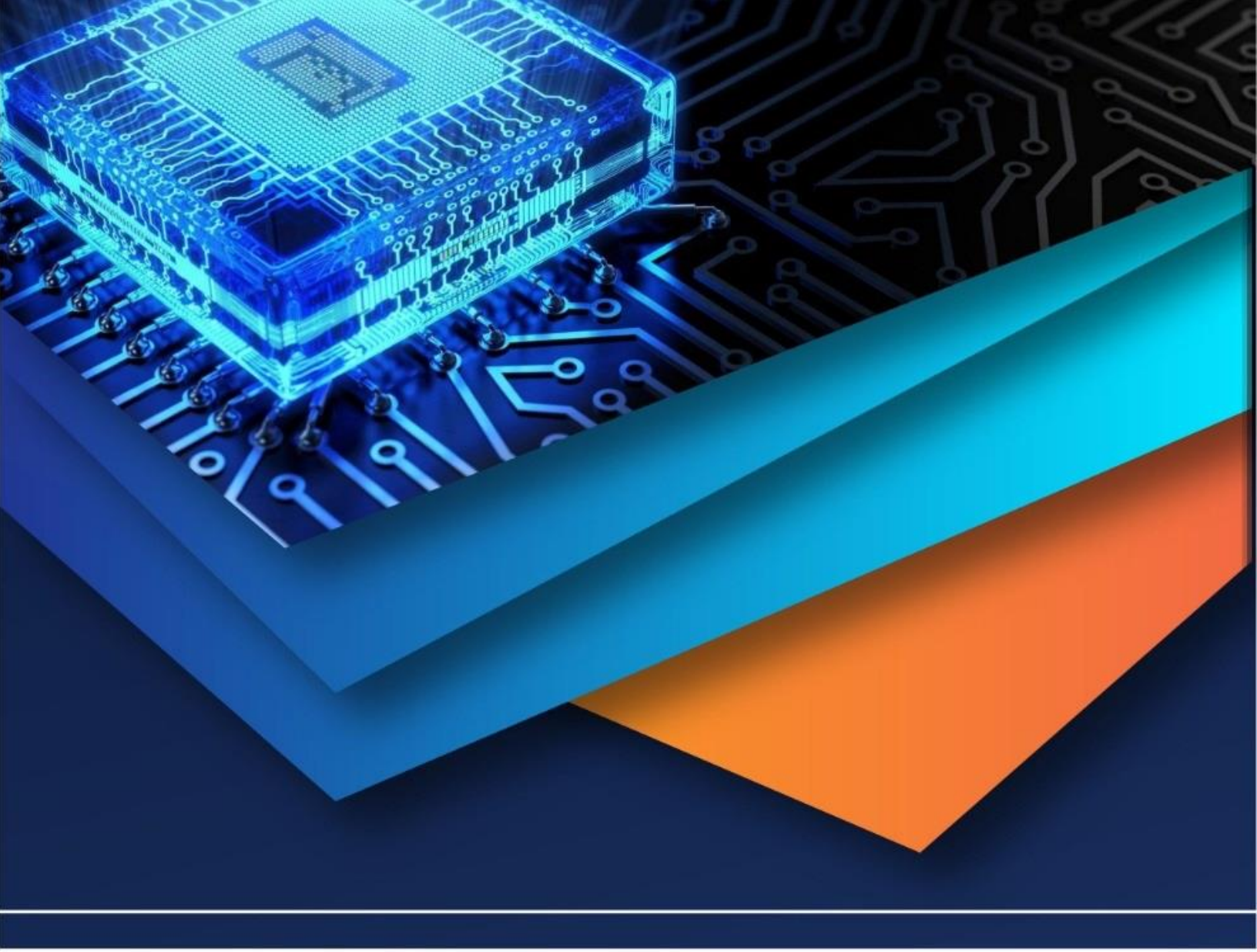

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