

УДК 004.38:530.145

Yevhen Sverhun¹, Olena Syvachuk²

¹ student of group CST-134 NU “Zaporizhzhia Polytechnic”

² senior teacher NU “Zaporizhzhia Polytechnic”

QUANTUM COMPUTERS: HOW THEY WORK AND HOW THEY CAN CHANGE THE WORLD

Quantum technology is developing in an era that could change the course of computing. It represents a major shift from the existing model based on classical computers. Based on this branch of physics, the basics of quantum computers have changed. Instead of bits, as in conventional computers, quantum machines work with qubits. However, what holds for bits cannot do the same for qubits; a bit is either a 0 or 1, something that can't be both at once. Since they are simultaneously in both states at each moment, quantum computers can perform myriad calculations at lightning speed. This capacity makes quantum computers superior to their traditional counterparts.

This paper aims to investigate quantum computers as a product of the new information age, analyzing their impact on various human endeavors while exploring the potential challenges and limitations associated with their implementation.

Many global technology giants like Google, IBM, Intel, and D-Wave have thrown their resources behind quantum computing research. One big leap came in 2019 when Google declared that the company had reached "quantum supremacy." Its quantum processor performed calculations in 200 seconds that would have taken tens of thousands of years to complete if performed by modern classical supercomputers, which is an achievement in this field.

Despite this, quantum computers are still in the experimental stage, and quite a few technical problems must be solved. These include the instability of qubits, their vulnerability to environmental conditions, and the indispensable ultra-low temperature environment in which they work.

The potential applications of quantum computers are many and diverse. In cryptology, quantum computers pose a dual threat: they can break existing encryption systems, and, at the same time, they can also introduce new ways of doing this that are effectively invulnerable to conventional attacks through quantum cryptology. In the medical field, quantum computing remains a key to drug development breakthroughs by granting unprecedented precision for simulating molecular interactions. Moreover, in artificial intelligence, the capability of quantum computers to speed up many machine learning processes gives us a chance to move forward along these lines and simplify data analysis. The future appears bright for the automation of very large data sets.

The social and economic ramifications of quantum computers warrant careful consideration. Their integration is anticipated to reshape global structures significantly. In the business realm, the organization of activities is expected to become more efficient, while logistics operations could see enhanced effectiveness and reduced risks. The finance and insurance sectors will also experience transformations as processes are optimized for real-time decision-making and forecasting.

This technological evolution will necessitate a new workforce equipped with specialized skills in quantum algorithms, prompting a re-evaluation of educational curricula to train professionals capable of navigating this emerging landscape.

In conclusion, quantum computers are not just another technological advance; they represent nothing less than a turning point for information processing and, thereby, the world at large. With significant benefits promised in science, medicine, finance, and security, the potential of quantum technology is huge. However, realizing these benefits will present formidable challenges. The ongoing development of quantum technologies might eventually guide humanity into unexplored territory, breaking new ground in knowledge and opportunities that are not yet fully understood.