**Configuring Simulator Computers for Quantum Computers and Their Use in Teaching**

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Aim:

This study aims to combine the Processor and Memory powers of Classical Computers and to provide a software environment that will simulate the superior features of Quantum computers to the service of researchers and students. For this purpose, we have shared our experiences about the architecture of the Quantum Simulator computer, which we have designed and put into practice at our university, under the following headings.

Material and Method:

The evolutionary development of quantum computers is called the second quantum revolution. The most important feature of this revolution is that application areas need higher computational power than classical computers.

Quantum computers are required for high-performance computations. It's essential for optimization, nano-scale, space technology, and industry-based calculations. Access to quantum computers is possible with limited means. Quantum Computing Inc. (QCI) solved BMW's optimization problem with 3854 variables using quantum computers[1].

Public or private institutions carry out various activities to disseminate quantum information technologies. Institutions such as IBM[2] and Qworld[3] are among the leading institutions. IBM[2]'s real experience study on quantum computers and training on using the simulators it has developed are of great importance in this field.

Scientific Aims:

The main goal of this presentation is to prepare environments that contain the necessary tools for teaching quantum computer programming to university students and where they can do cloud-based studies. Another goal of ours is to use classical computers for high-performance calculations to solve problems that will take years to simulate quantum computers, especially mathematical calculations, in a shorter time with quantum algorithms and share this process with the scientific world.

Manner of Application

A- As hardware features, There is a processor unit with at least 64 cores, supporting processor virtualization, capable of serial calculations, containing SSE4 instruction set to feature, AVX feature to be used in vector calculations required for quantum simulations, and FTPM support for secure platform applications.

The random access memory (RAM) DRR4 model required for this computer has a total of 256 GB memory, an ECC feature as an error correction mechanism, and a random access speed of 3600 and above Megatransfer (MT/s) and works as four channels. It has a graphics card with over 10GB GDDR6(X) memory. It supports SR-IOV virtualization, which contains more than 200 tensor cores and 8960 CUDA cores to be used in quantum machine learning applications to compare with classical methods. It will enable the distributed use of the graphics card by students. To provide the best experience for students, an SSD with a memory size of 2TB with NVme standard sizes using the PCI-4 channel with read-write speeds of at least 4500-3500 MT/s respectively, and a 1TB SATA-3 HDD for long-term storage of server and students data has. It is a CMR type which is more suitable for RAID on this HDD.

B- Software: The Linux Operating System has activated a cloud-based system. All quantum framework studies systems developed with Python are integrated. User management and services are communicated with docker. The software on which researchers can provide experience is as follows.

1- Qiskit

2- Cirq

3- Qutip

4-Project Q

Conclusion:

Researchers in Physics, Mathematics, and Computer science; solved various problems related to their field of study using a quantum simulator. The system we use is at the service of the students who study Çanakkale Onsekiz Mart University Computer Engineering, students who take quantum computers I-II, and researchers who want to work in the field. Up to the present, more than 200 students and researchers have used the system. They used not only quantum algorithms but also geophysics, linear equation systems, differential equation systems, high-dimensional optimization calculations, machine learning, artificial intelligence, and data processing techniques that require high computations. Libraries developed by researchers or libraries distributed as open source are uploaded to the system. 30 researchers can work simultaneously.

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