

# Impact of Quantum Computing in India and it's Applications.

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**Abstract** - Quantum Computing has brought us a new line of scientific era, predicted entirely inconceivable possibilities and influenced several areas of modern technologies. Quantum technology is going to be the next step to make computers both faster and smarter. It is laying the foundation for complex codes, computers that can work with numbers at an incredible rate, and super speed database searches. All these functions will be important to deploy Machine learning and Artificial Intelligence at a greater scale. Quantum technology could spur the development of new breakthroughs in science, for example medications to save lives, machine learning methods to diagnose illness sooner, cryptography, financial modeling, cyber security, weather forecasting and climate change. It is expected that many commercial applications would emerge from their theoretical concepts which are developing in this line. India's quantum mission, is to be administered by Department of Science and Technology (DST) the recent investment of 8000 crore in India on quantum computing will ensure that India can make significant contributions in this part. One of the aim being developing a 50-qubit computer within next few years. This will lead to spearhead scientific breakthroughs and boost quantum technology which will eventually lead in the growth of India's economic.

**Keywords** - Artificial Intelligence, Cryptography, Cyber security, Machine Learning, Medications, Cryptography, Cyber security, Weather forecasting, Quantum Computing.

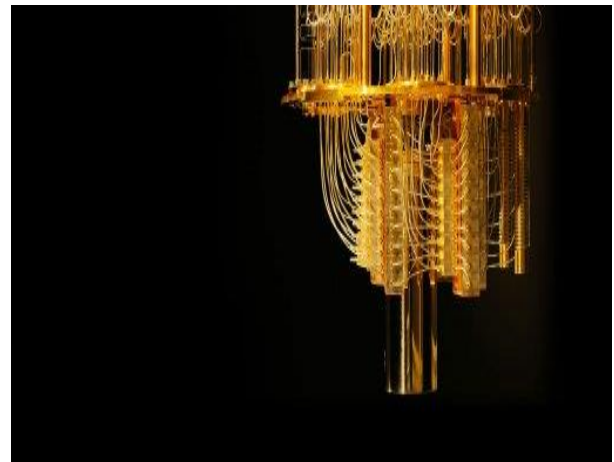
## I. INTRODUCTION

This section should be succinct, with no subheadings. In the quantum realm, physics behaves quite differently from the natural observed ways we're used to, and traditional computers just stop making sense. We are approaching real physical restrictions for technological advancements.

To overcome the issue scientists are trying to use unusual quantum properties such as quantum tunneling, where an electron much smaller in size can transfer itself through the blocked passage to their advantage by building quantum computers.

In classical computers bits are the smallest unit of information which is either 1 or 0. Quantum computers use qubits which can be set to either 1 or 0 values. A qubit can be any two level quantum state such as spin and

magnetic field, or a single photon. 0 and 1 are the system's possible states, in the quantum world the qubit doesn't have to be one of those, it can be in any proportions of both states at once. This is called superposition. But as soon as we test it's value, by sending a photon it has to decide to be either vertically or horizontally polarized. So, as long as it is unobserved the qubit is in a superposition of probabilities for 0 and 1, we can't know which it'll be. But the instant we measure it collapses into one of the definite states and hence superposition is a game changer.



Source: [www.quantamagazine.org](http://www.quantamagazine.org)

A really uncanny and new property qubits can have is Entanglement. A close connection that makes each of the qubits react to a change in the other's state instantaneously, no matter how far they are apart. This means when we are measuring one entangled qubit, we are changing the properties of its partner qubit. Due to these properties Quantum computers are vastly superior in some areas. One of them is database searching. To find something in the , a classical computer has to test every single entries. Quantum algorithms need a lot less time which for large databases is a huge difference. The most famous use of quantum computers is ripping or destroying IT security. Right now, browsing, email, and banking data is being kept secure in encryption method in which you give everyone a public key to encode messages only you can decode. The problem is that this public key can actually be used to calculate your private key. Doing the necessary math on any normal computer would

literally take years of trial and error .But a quantum computer can do it in seconds. Another really exciting use has to be the Quantum simulations. Simulations of the quantum world are very extreme of resources, and for bigger structures , such as molecules they lack correctness. Quantum simulations could provide new intuition on proteins that might revolutionize the area of medicine. Quantum computers can act as a specialized tool or a big revolution for humanity. That is why this topic is such importance and we should use it to advance in technology I India.

## II.RESULTS AND DISCUSSION

### CYBERSECURITY AND CRYPTOGRAPHY

The study of technic that secures the communication between the sender and the receiver , we use cryptographic technics for security. Some of the popular cryptographic algorithms are AES-256 , RSA and SHA-256 ,mostly for security layer buildings . These algorithms are considered to be robust and unbreakable by conventional computers but it becomes painfully easy for the quantum computers . Algorithms become substantially weakened by these quantum computing

For secure computing and cryptography we use UNIVERSAL QUANTUM computers among three types of computers

- 1.Quantum annealing(least powerful)
- 2.Anealing quantum
- 3.Universal quantum(more powerful)

The popular algorithms AES-256,RSA and other are designed and depends mostly on mathematics like prime factorization to create public-private key pairs .For normal computers it is very complex and essentially impossible anymore to break. But quantum computers speeds up the factorization and easily breaks through and calculate the keys.

What quantum computers can do?

\*Factor Primes :Encryption algorithm like RSA,SSL are based on fact that factoring of would taken millions of years on a classical computer but for quantum computer it could take few seconds

\*Secure communication :Networking based on the quantum computing technics is highly secured communication

The eaves-dropping is very destructive thing in signal hence quantum networks provides impervious to hijack.

Important Characteristics of the quantum computers that change the cyber security:

1.Speed :Quantum computer become the turning point technology to cyber security because of its high speed and it's capability to solve the complex problems.

2:Security:The most remarkable impact of quantum is in security "Distribution functions" this helps to sharing the cryptographic keys between remote parties without explicit intervention.

The data transform operation performed by the quantum computers to exploit effects that are not present in conventional computers. Some of the companies like GOOGLE,MICROSOFT are being developing the algorithms that are quantum-safe .they are in theoretical and testing stages. Besides the risks of quantum computers , it provides very powerful security to critical and personal data than now possible.



Source:<https://www.extremetech.com/>

Encryption is a way of security and privacy for our online lives – from home business to banking and healthcare. It protects everything from state secrets to sensitive data. As the 2019 Global Risk Report put it, encryption forms the "scaffolding of digital life".

To say simply, without quantum-safe cryptography and security, all data that is being transmitted on public channels now – or in the future – is not safe and hence vulnerable . Even encrypted data that is safe today can be stored for later decryption once a working quantum computer of sufficient capacity becomes available.



Source: <https://www.focaloid.com/blog>

## III. HEALTHCARE

- DRUG RESEARCH:

Molecular comparison plays an important role in companies undergoing drug design and discovery where companies has to take over hundreds of millions of comparisons .On classical computing machine it is limited to molecular size but a quantum computer can

compare molecules that are much larger which accelerates the speed of pharmaceutical advancements and cure for much of diseases .

- **DIAGNOSTICS :**

Quantum computing allow you to boosting AI capability which simultaneously develops machine learning something that is already being used to aid pattern recognition.

High resolution MRI gives you greater details and helps to screening the diseases.

- **DRUG DESIGN AND DEVELOPMENT :**

This is a challenging and also a tough job in computational chemistry. Drugs are developed using the method called trial and error which is risky and expensive too. While this quantum computer become a game changer has it can compute in effective way of analyzing how a drug will react, Which saves lots of money and time.

This biomedical and chemical analysis could help companies carry more drug discoveries.

Human body is a complex organism ,while the pharmaceutical markets have released many lifesaving drugs many barriers hold us back from getting the knowledge of its maximum potential.

Classical computing is not powerful enough to predict the way drug will react within an every individual's particular genetic unique composition according to different environmental factors .



Source:<https://www.google.com/>

## WEATHER FORECASTING

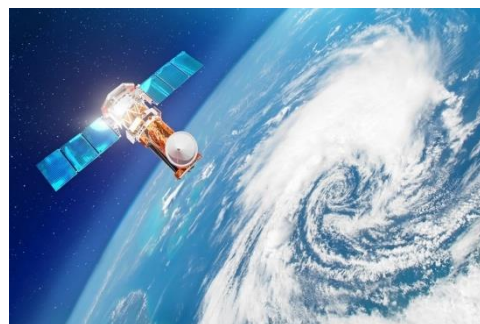
In the field of weather forecasting it is impossible to get 100% accurate data and to be exact with prediction when the weather is eventually changing, the advanced warnings are very necessary to minimize the disastrous events and the loss.

We need a very high speed computational power to keep an updated record of an weather to predict when an innocent looking storm might become dangerous . Many of the super

computers have dedicated to weather forecasting but we fail accurate.

These quantum computers can change the view point of the people about weather predictions , this is because of the quantum computers make use of the uncommon properties of matter at very small scale but these quantum computers are not commercially workable and still it is in beginning stage.

When quantum computers having 12 to 16 qubits were built in the lab hoped that large scale quantum computers will be able to solve certain problems more quickly . Because quantum computers analyze all the obtainable data at once ,it gives the metrologies accurate idea about the weather it is clear that quantum computer helping in weather forecasting it will save much of the properties and lives .



Source: [www.azoquantum.com](http://www.azoquantum.com)

## IV. CONCLUSION

Quantum computing has a huge potential in improving the current technology. It can take us to new heights in many fields and find solutions to problems which will take thousands of years in classical approach. So this will help us lead our life and make it easy. And by investing in such technology our country can achieve new heights.

## V. FUTURE SCOPE

Once Quantum computers are efficiently developed it will revolutionize computing using quantum bits and find solutions and solve problems which were previously unapproachable.

Conflict of Interest: Safety of data can be easily breached by quantum computers.

## REFERENCES

- [1] <https://www.raconteur.net/risk-management/five-ways-quantum-computing-will-change-cybersecurity-forever>
- [2] <https://www.weforum.org/agenda/2019/07/why-quantum-computing-could-make-todays-cybersecurity-obsolete/>
- [3] Quantum Computing Kurzgesagtyoutube.
- [4] <https://medicalfuturist.com/quantum-computing-in-healthcare/>
- [5] <https://www.healthcareitnews.com/news/quantum-computing-could-turbocharge-healthcare-analytics-ai>
- [6] <https://www.scientificamerican.com/article/new-encryption-system-protects-data-from-quantum-computers/>
- [7] <https://www.azoquantum.com/Article.aspx?ArticleID=98>