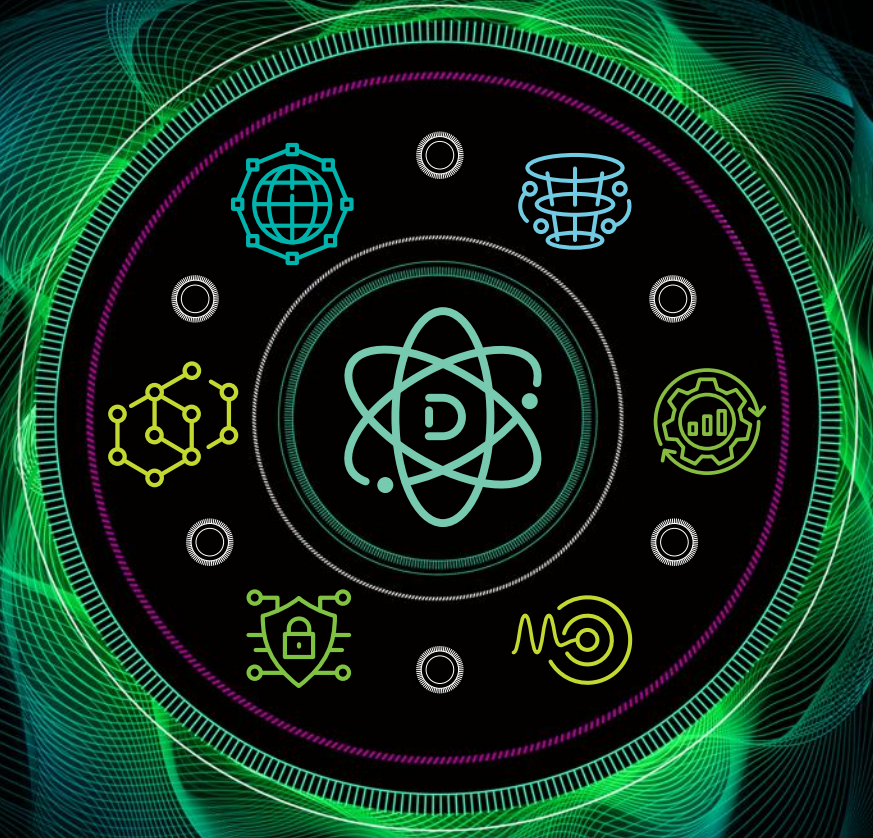
Quantum Computing Use Cases

Optimizing human flow for disaster damage control

Kyushu Electric Power and Sumitomo Corporation



New Energy and Industrial Technology Development Organization (NEDO)

Kyushu Electric Power and Sumitomo Corporation: Optimizing human flow for disaster damage control [2023/10]

Concept

Industry	Transportation
Means	Human Movement _ Land Transport
Method	combinatorial optimization
Category	Ising*

Background

- In recent years, with the increase in natural disasters and the aggravation of damage, **measures to prevent delay in evacuation** are required.
  - ✓ River flooding and flood disasters frequently occur due to heavy rain in various parts of Kyushu.
- Kyushu Electric Power has concluded comprehensive partnership agreements with local governments and financial institutions for **safe and secure community development** and dynamic and attractive community development, and is working to **resolve issues facing the Kyushu region and promote sustainable community development.**
  - ✓ **Evacuation support for local residents in the event of a disaster** is promoted as one of the measures.

Issues and motivation to be solved

- When evacuating in the event of a disaster, if individuals try to move as quickly as possible to reach an evacuation site, they may concentrate on a specific road and become in a dangerous situation. Therefore, **prompt evacuation instructions and guidance of evacuation routes are necessary.**
- **The problem with classical computers is that they take a lot of time to calculate,** he said, as there are so many options for evacuation routes to choose from.
- Since quantum technology is expected to efficiently solve optimization problems, this study **examines the application of quantum technology to calculate the optimal evacuation route for local residents by utilizing the knowledge of quantum technology accumulated by Sumitomo Corporation**

Problem setting as a quantum computer

- As the environment changes from moment to moment while residents are evacuating, the evacuation shelters allocated in advance are not always optimal, so **calculations to dynamically determine the evacuation route and evacuation destination for all local residents** are performed so that all residents can complete evacuation without delay.
- **To inform local residents of an optimal route to an evacuation center in consideration of traffic jams and accidents during evacuation and collapse of bridges during evacuation.**

Reference: Kyushu Electric Power Co., Inc. "Quantum Transformation by Sumitomo Corporation | Yusuke Okazaki," Q2B24 Tokyo (https://www.kyuden.co.jp/press_h231030b-1.html https://www.youtube.com/watch?v=Gqpj1R_9aGk)
*Ising: A computing approach, mainly associated with quantum annealers and simulators specialized for the Ising model, in which a problem is first formulated as an Ising model and then solved computationally. It is particularly well suited to problems that involve finding the optimal combination from a vast number of possibilities.

More use cases are available on our website. We invite you to explore them.
https://www.quantum-computing-use-cases.nedo.go.jp/english/

More Use Cases

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This collection of use cases was obtained as a result of the work commissioned by the New Energy and Industrial Technology Development Organization (NEDO) "Cyber-Physical Development Business of Quantum/Classical Hybrid Technology/Study of Use Case of Quantum Technology" and the “Post-5G Information and Communications System Infrastructure Reinforcement R & D Project (Quantum Industrialization)/Comprehensive Study for Promoting the Industrialization of Quantum Computers”.