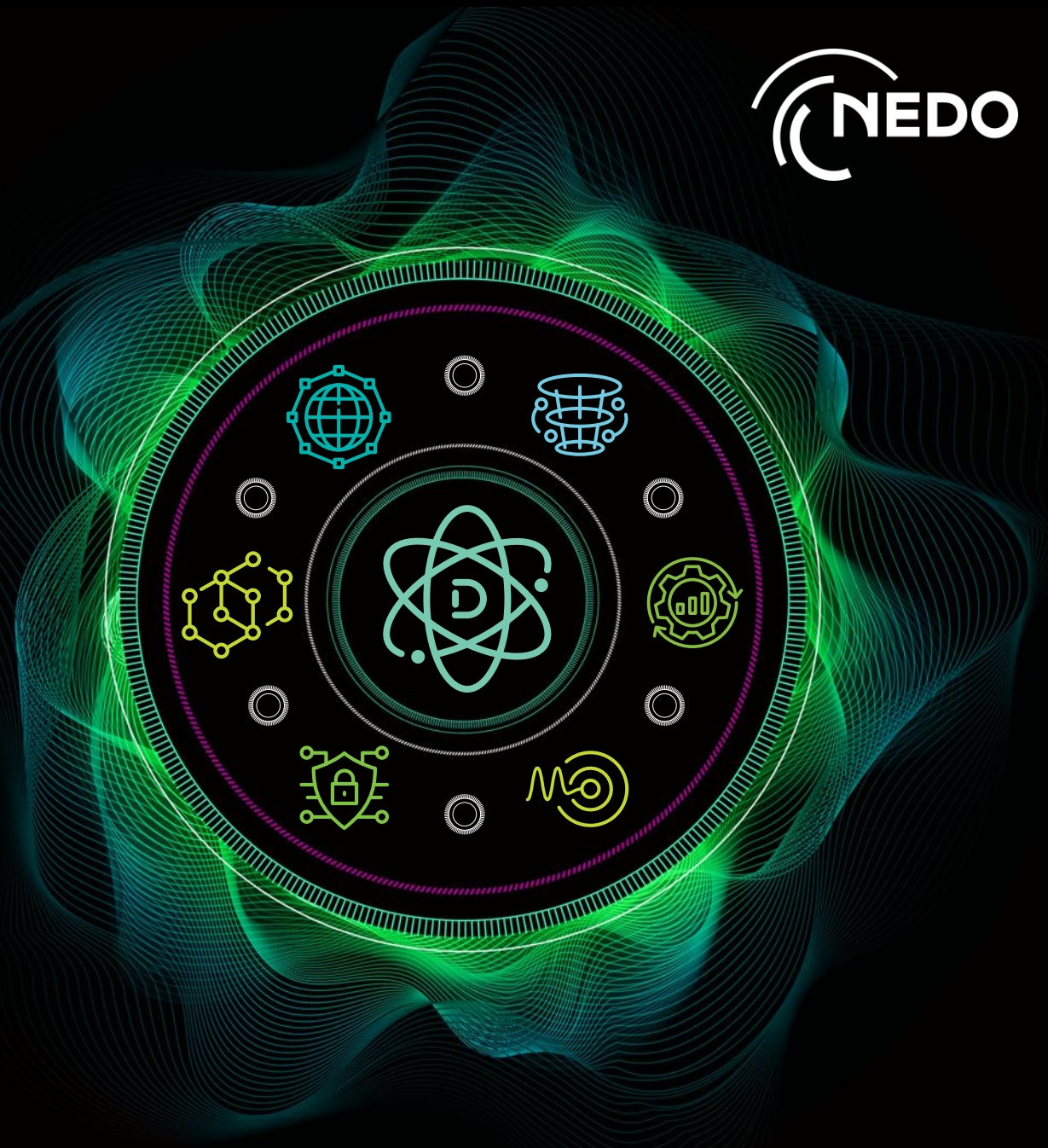
Quantum Computing Use Cases

Fast Generation of Large Gantt Charts Using a Unique Quantum LLM

KandaQuantum



New Energy and Industrial Technology Development Organization (NEDO)

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Validation

Industry	Other
Method	AI,
Process	inference
Category	Ising*

Background

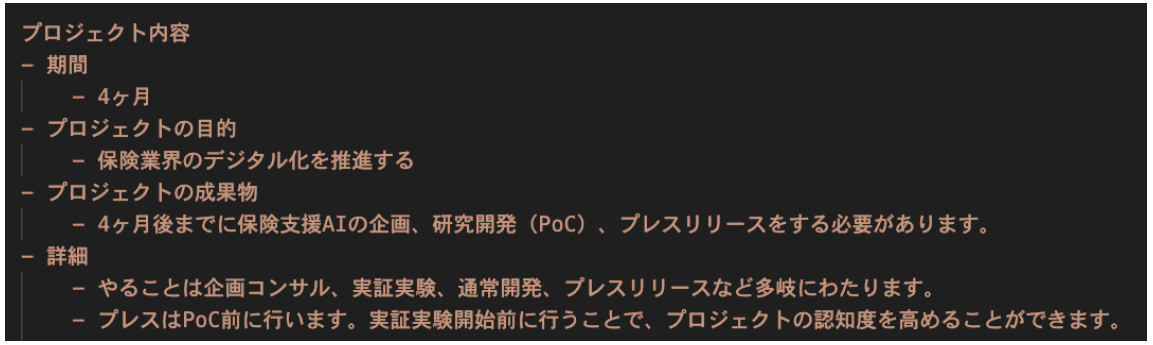
- In recent years, LLM (Large Scale Language Model) has been rapidly developed and utilized in a wide range of applications, but **it is difficult to answer optimization problems with complicated logic with high precision, and the application range is limited**.
- **The schedule optimization by conventional LLM was not effective for large projects for the following two reasons.**
  - ① Dealing with multiple people and tasks requires a lot of computation
  - ② Accuracy drops significantly as schedule complexity increases

Issues and motivation to be solved

- We aim to solve the following problems by utilizing quantum technology.
  - ✓ The learning information is fed into mathematical models and LLM prompts, **generating itself with quantum LLMs to reduce computational complexity**
  - ✓ Combining LLM and Quantum Technologies to **Enable Efficient Use of Learning Data**
  - ✓ Effective solution of the problem of computational complexity such as combinational explosion and **realization of multi-modal utilization of voice, image and text**
  - ✓ **Enable interactive communication with AI** by solving speed at large scale computations
  - ✓ Quantum technology **improves the accuracy of responses to logically-complex optimization problems and broadens applications.**

Problem setting as a quantum computer

- Quantum LLM (quantum annealing and quantum inspired technology) is strong in order receiving AI, no-code workflow AI and promanage AI.
- **In this project, large - scale, high - speed and high - precision Gantt chart generation was realized by quantum promotion AI "CalqPM" which combines LLM and pseudo - quantum technology.**
- Quasi-quantum technology is used to **simulate the characteristics of quantum computers based on mathematical models of mathematical optimization**
- This project uses pseudo quantum technology on a classical computer, but **even if it is replaced with a quantum computer such as D-wave, it can be operated without major changes to the mathematical model.**



Input image to Quantum Professional Manager AI (employee information is also entered separately)

Reference: DIGITSL SHIFT TIMES"KandaQuantum uses AI to automatically generate Gantt charts" (https://digital-shift.jp/flash_news/FN230626_3), PRTIMES"Commenced the CalQamel Project, a domestic "quantum generation AI"" (https://prtimes.jp/main/html/rd/p/000000130.000082094.html)

*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.

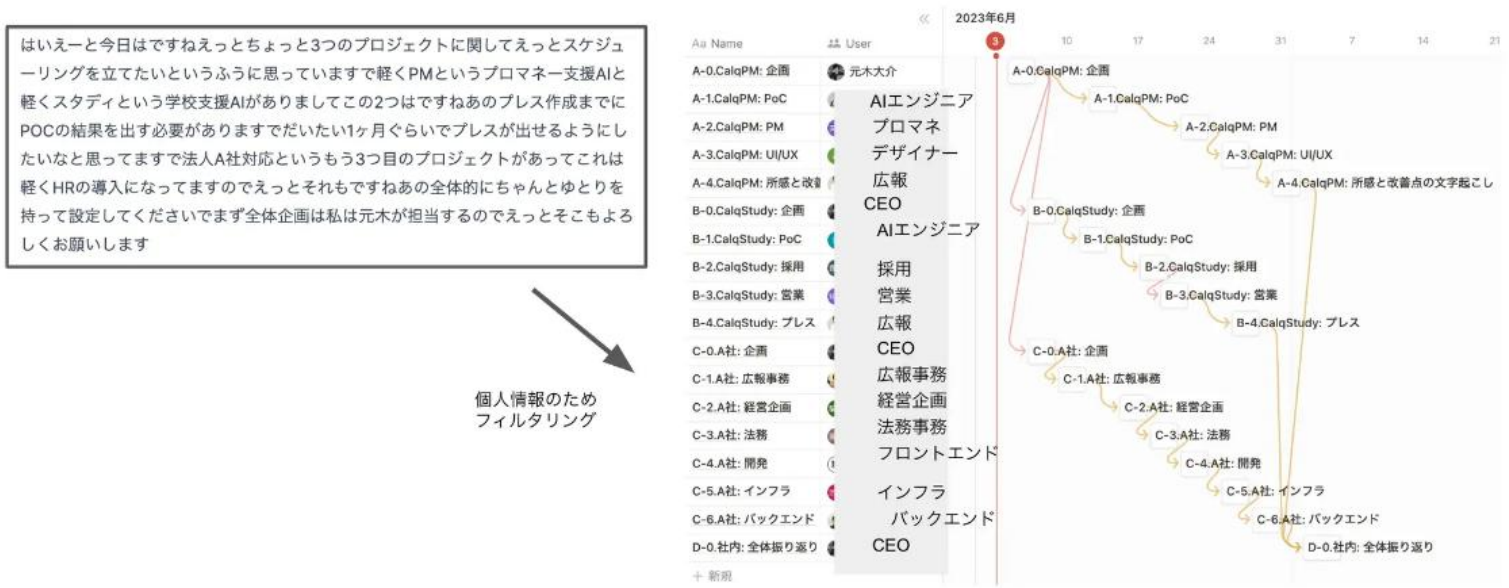
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Expected business benefits

- Gantt chart of 50 tasks in 4 months for 17 people **Gantt chart output in 4 minutes considering task dependency, job type matching and resource status**
- This QPR AI is expected to **contribute to improving the stability and speed of project promotion in large-scale networked projects,** such as agile projects, autonomous distributed organizations (DAO), and teal organizations.



Illustrative Output of Quantum Project manager AI corresponding to the speech input

Reference: PRTIMES"GPT-4 x Quantum: Promane AI, Notion in production" (https://prtimes.jp/main/html/rd/p/000000122.000082094.html)
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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

New Energy and Industrial Technology Development Organization (NEDO)
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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".