日本―EU　国際共同研究「防災」 2019 年度　年次報告書	
研究課題名（和文）	安全かつ効率的な災害初期対応
研究課題名（英文）	First responder Advanced technologies for Safe and efficienT Emergency Response (FASTER)
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1．日本側の研究実施体制

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２．日本側研究チームの研究目標及び計画概要

The research objectives for the Japan team was to develop a distributed ledger framework capable of meeting the following requirements:

1. The need for security in the communication
2. The need for trustworthiness
3. The need for real time in intercommunication
4. The need for offline connectivity
5. The need for pre-processing and post-processing
6. GDPR: The need for privacy when collecting data
7. GDPR: The need to allow personal data to be forgotten

3. 日本側研究チームの実施概要

The blockchain-based frameworks are slow, computationally intensive, non-scalable, require transaction fees and have a separated have an inefficient consensus approach to trustworthiness. So the Japan team developed its own approach by employing an existing distributed ledger technology framework called IOTA (https://www.iota.org/). However, the team made significant and novel modifications to the framework by introducing an ontological enriched adaptation as described below:

In the IOTA architecture, an IoT node is implemented using the Iota Reference Implementation (IRI), which consists of open-source Java software for the IOTA protocol.　IRI nodes are the core of the IOTA network and are responsible for the following functions:

- Validate transactions
- Store valid transactions in the distributed ledger
- Allow clients to interact with the IRI and have their transactions appended to the ledger

In order for this to work, IOTA employs the concept of a permanode called a chronicle that stores all the transactions that reach the IRI node in a distributed database.　The reference chronicle mechanism is supported by a Scylla database (https://www.scylladb.com/) because of the speed and scalability that this NoSQL database provides. However, this project goes one step further and substitutes de Scylla database with a more advanced and comparatively scalable database called Grakn.ai, which in effect enhances de IOTA framework with an ontology embedded in the knowledge representation of Grakn.ai. The reasons for substituting the ScyllaDB with Grakn.ai are as follows:

- Instead of using hash signage to store transactions in the database, the framework uses the IP addresses of the nodes to initiate encrypted data streams, which greatly improve the efficiency of the communication while providing the needed security.
- With Grank.ai, the framework uses TensorFlow pre-processing to mask private information from being cryptographically stored in the Tangle. For example, we can mask streamed data or captured faces from pictures and numbers from houses or car licenses, to meet the need to allow data privacy when collecting or transmitting data.
- We can also use of hyper-relations embedded in the Grakn.ai core to perform reasoning to discover relations with GraQL, an advanced declarative query which serves both as a Data Manipulation Language (DML) and a Data Definition Language (DDL).

As a result, during this year, the Japan team developed first and only ontology oriented distributed ledger technology for trustworthy and secure IoT communications.