日本—EU　国際共同研究「災害初期対応技術」 2020 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

氏名	所属機関・部局・役職	役割
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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:

ワークパッケージ No. 3 : Requirements, specifications, and system architecture

- To collect and revise the end-user requirements and the FASTER technical specifications.
- To prepare and define the end-user requirements and the FASTER architecture.
- To collaborate with end-users to comprehensively analyze their expectations and formulate them into user requirements and use cases.
- To monitor the usability and performance of the tools.

ワークパッケージ No. 4 : IoT Platform, Wearables, and Social Media Sources

- To design and implement a robust, resilient, and trustworthy communication framework for the deployed IoT sensors.
- The provision of a compliant IoT middleware and devices that enable the transactional model
- The definition and provision of system components that enable the transactional model in wearables for humans and K9 units.

ワークパッケージ No. 6 : Resilient communication solutions for first responders

- To provide the design and initial base implementation of the distributed framework of trust based on Blockchain and Smart Contract Technologies.
- To enable resilient communication solutions for first responders.

ワークパッケージ No. 9 : Integration responders

- To start integration planning so that the distributed framework of trust can interoperate with other components of the FASTER network in a private, secure, and minimally invasive manner.
- To test in the laboratory environment and validated for deployment and usage in a real-world environment.

ワークパッケージ No. 10 : Pilot Demonstration and Evaluation

- To work with the EU team to design appropriate scenarios that incorporate the distributed network of trust components for demonstrating the FASTER system,
- To demonstrate the capabilities of the distributed network of trust as a component of the FASTER system in pilots that simulate real-life conditions of the work of first responders.

ワークパッケージ No. 11 : Dissemination and exploitation

- To collaborate with the EU counterparts and to disseminate the results.
- To deal with the interactive dissemination of the project results in Japan and abroad.
- The definition of the Dissemination and Communication channels for the project, the setup of the Japan team website
- To plan and develop actions for future sustainability and further exploitation to facilitate the future adoption of FASTER results by first responders in Japan.

3. 日本側研究チームの実施概要

The FASTER project had the following requirements for communication among IoT devices:
- Permit a secure encrypted transmission in real-time.
- Provide resilience on low to a non-existent internet connection.
- Support edge-level intelligent processing of data streams to fulfill the European General Data Protection Regulation (GDPR) privacy requirements.

To meet these requirements, the Japan team set itself to develop a unique distributed-ledger technology (DLT) framework to provide security through decentralization and high performance through scalability. Thus, inspired by a DLT framework called IOTA, the team developed a first-of-its-kind IoT-oriented DLT from scratch, called it *AIngle*, which provides the following:

- The design of AIngle permits the transmission of massive data (IoT).
- AIngle is a semantic DLT, i.e., distributed ontologies that improve the M2M, P2P, and programming communication experience.
- AIngle uses a validation architecture based on DAG (Directed Acyclic Graph) that drastically improves data validation times.) It also benefits almost unlimited scalability, i.e., the more nodes, the better the data transmission speed.
- Due to GDPR, data privacy requirements include a data anonymization algorithm (digital twins) working with AI and Grakn.
- AIngle includes a data communication system called ACM (Authenticated Crypto Message) that allows customizing the information communication channel (through a private main net or via streaming) without sacrificing security through data encryption in both cases.
- AIngle provides quantum-attack-proof cryptographic security.
- AIngle does not require a "coordinator."

As a result, during this year, the Japanese team was focused on developing the first stage of development, performing programming and testing.
The goal was to be ready for the first AIngle's pilot experiment. Listed below are some of the significant achievements in the corresponding period:

- We successfully tested the first stage of development (interfacing, node creation, transmission of sensor data-photographs, and encryption). An initial experiment also compared the performance of AIngle with two blockchains used as reference (Ethereum, based on linear Blockchain and

IOTA, based on DAG).

- In the experiment, concepts such as TPS (transactions per second), voltage consumption, node performance, the integrity of transmitted data, among others, were tested with positive results)
- We converted the requirements of FASTER's technological partners into specifications taken into account in the AIngle architecture.
- KGU completed successful documentation, collaboration, and technical deliverables.
- We proposed a pilot project to be carried out in Japan to test the operation of **_AIngle_** in a real-world scenario.
- Successful participation in an online conference in Brussels with the topic "The promise of blockchain: DLT based applications re-shape data storage and sharing, but can they be compliant with the EU data protection law?".
- The Japanese team is highly motivated to complete the objectives set at the beginning of the project.