

## The IntelloT Framework

The current cloud-centric IoT model has multiple limitations, such as unreliable cloud connectivity, limited bandwidth, long reaction time, lack of self-awareness, and privacy concerns. The next generation of IoT applications must move to the edge or closer to the operational assets to amplify the level of their performance, create a more stable operation, and enable faster response. This transformation needs to build on localized IoT environments comprised of heterogeneous devices (e.g., edge computers as well as resource-constrained devices) that can collaboratively execute highly automated IoT applications – which include functions for sensing, actuating, reasoning, and control. IntelloT will develop an architectural framework to enable IoT environments for semi-autonomous applications endowed with intelligence, built-in security, and trust and evolving with the human-in-the-loop.

IntelloT's framework is based on three pillars:

### 1 Collaborative IoT

IoT applications are distributed and attentive. Their collaboration is supported by autonomous software agents of a novel hypermedia-based multi-agent system (HyperMAS).

### 2 Human-in-the-Loop

IoT applications cannot be completely autonomous in how they decide and act; they need to keep the human-in-the-loop for control and optimization of their Artificial Intelligence.

### 3 Trustworthiness

IoT Solutions need to address security, privacy, and trust requirements early in the design phase. The computation and communication infrastructure must be efficient, reliable, and trustworthy.

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## About IntelloT

IntelloT is a Pan-European Research Project supported by the European Commission with €8 million EU funding. IntelloT comprises a consortium of 13 partners spread across 9 countries which bring together key expertise and technologies for the next generation IoT and build the basis for an ecosystem on top of the IntelloT framework beyond the project. Enabling technologies such as 5G, cybersecurity, distributed ledger technology, Augmented Reality, and tactile internet, the project champions end-user trust, adequate security, and privacy by design.



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# IntelloT

Championing intelligent, autonomous human-centered IoT solutions in agriculture, healthcare and manufacturing





## Semi-Autonomous Operations for Agricultural Vehicle Fleets

According to ILO estimates, at least 170,000 agricultural workers are killed each year, making it one of the three most hazardous sectors. Many of these deadly accidents involve farming vehicles. IntelloT incorporates the human-in-the-loop in the intelligent IoT environment of a semi-autonomous agricultural vehicle (e.g., tractors) in collaboration with other devices to improve safety, reliability, and security.

The vehicle is equipped with cameras and sensors, and can thus semi-autonomously perform tasks such as plowing or spraying a farm field. Human intervention is needed in uncertain situations – animals on the path, unknown barriers, or unclear sensor data. A human operator takes remote control of the vehicle and based on the interaction between the person and the vehicle, the AI models of the vehicle get refined. VR technologies are employed to display a 360° live stream from the vehicle. Additional data can be included to broaden the view and minimize external effects. New business models are enabled based on smart contracts that ensure that the field owner authorizes the requested services and possesses the area in which the smart equipment operates.



## Collaborative IoT-Enabled Support for Remote Patient Monitoring in Healthcare

Cardiovascular diseases (CVDs) are the number 1 cause of death globally, taking an estimated 17.9 million lives each year. A new generation of IoT can help prevent a significant number of deaths by facilitating guided recovery and rehabilitation at home. AI-driven IoT applications are able to provide support for health monitoring and interventions, while carefully preserving the security and privacy of patients' data.

Patients can be equipped with sensors and devices – such as smart wearables – minimizing the need for hospital visits to perform rehabilitation. The devices constantly monitor and measure relevant data. This way, patients can re-immers into their normal environment safely and are managed during their recovery mostly remotely, to increase their comfort and reduce risks related to frequent hospital visits. Clinicians act as human-in-the-loop. They receive updates and are notified when their intervention is required, with the support of an AI algorithm trained to analyze the data provided by sensors. Digital consent across the user groups and across devices can be managed via smart contracts based on distributed ledger technology (DLT).



## Human-Machine Cooperation in Shared Manufacturing

Even a minor bottleneck in a manufacturing process can result in a huge loss of resources. IntelloT will empower flexible and individualized production using collaborative IoT based on AI, which can be supported by a human on-demand. This solution will open new business opportunities by enabling shared manufacturing plants with multiple customers utilizing manufacturing as-a-service.

Within the IntelloT framework, an intelligent IoT environment derives a production plan from product data received from a customer, selects machines for production steps, and plans optimized transport paths.

Smart contracts based on distributed ledger technology are concluded between customers, plant operators, machines, and robots. Transport is done by robots and AGVs, guided by in-built AI. Whenever AI is not sufficiently confident about a production step or workpiece handling, e.g. facing an exceptional workpiece, a human-in-the-loop takes over control. The IntelloT infrastructure will enable tactile, reliable, and secure remote operation using AR and VR technologies. Learnings from human intervention are federated between distributed AI.

### Two Open Calls for SMEs & Startups

IntelloT will conduct two Open Calls and invite several new partners to join the project. SMEs and startups will receive up to €150,000 to execute pilot projects alongside the 13 consortium partners to apply the IntelloT technology, improve their products and services, and create new jobs.

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