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SemantiCom: Task-Oriented Semantic Communication Solution with Hardware Realization

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Researchers at Purdue University developed a task-oriented, semantic-level communication system called 'SemantiCom'. This technology ensures reliable, timely, and bandwidth-efficient communication between remote operators and robotic systems. Compared to conventional wired and wireless communication networks that frequently fail to deliver the necessary bandwidth, stability, and timeliness required for critical operations, Semanticom can integrate task awareness into communication and only transmit task-critical semantic information instead of raw sensory data. Moreover, the technology drastically reduces data load and improves timeliness and reliability. Semanticom also provides a hardware-integrated, plug-and-play module that can seamlessly work with existing wireless infrastructure and enable rapid and low-cost deployment, unlike advanced solutions that rely on costly and disruptive high-bandwidth infrastructure upgrades. This technology brings practical semantic communication to the present, ensuring reliable semantic communications even in congested and constrained environments without advanced infrastructure.

Technology Validation: A plug-and-play cost-effective hardware realization of our semantic communication solution was developed using Nvidia Jetson Orin Nano embedded GPUs N200 and USRPs.

Advantages:

-Integration with existing infrastructure

-Reduces data load

-Improves reliability and timeliness

-Rapid and low-cost deployment

Technology ID

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Category

Computing/Networking & Connectivity/5G & 6G Networks

Robotics & Automation/Autonomous Systems & Perception AI

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Applications:

-Smart manufacturing

-Industrial robotics and automation

-Autonomous vehicles and teleoperations

-Network and edge AI

TRL: 2

Intellectual Property:

Provisional-Patent, 2025-04-10, United States

Keywords: Semantic communication systems,Task-oriented wireless communication,Bandwidth-efficient networking,Real-time robotic communication,Plug-and-play communication hardware,Edge AI networking,Industrial IoT communication,Reliable low-latency wireless,Smart manufacturing connectivity,Autonomous vehicle networks,Teleoperation communication,Embedded GPU networking,Wireless infrastructure integration,Data load reduction technologies