nBUS: The Sensor Network Core

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Abstract *This project introduces nano-bus (nBUS): The Sensor Network Core, a lightweight and modular communication protocol specifically developed for wearable systems utilizing the Body Area Network (BAN) paradigm. A BAN comprises multiple sensor nodes distributed across the human body to capture static and dynamic measurements—including motion data, physiological signals, and environmental parameters—facilitating comprehensive monitoring of the user's condition and activity. nBUS operates at the application layer (Layer 7) of the ISO/OSI model and is optimized for deployment on microcontrollers in resource-constrained environments. It enables reliable, real-time communication between sensor nodes and a central controller. The protocol supports up to 127 nodes, each capable of integrating up to 31 sensors and 31 actuators, and uniquely identifies each node by name, type, and data format. This allows for granular addressing of individual sensors or entire modules in the whole network. nBUS defines a set of 15 core functions, encompassing device control, power management, parameter configuration, memory access, data exchange (including calibration routines), and device identification. It also supports broadcast communication for synchronized operations and enables automatic data acquisition initiated by the central control unit. The protocol adopts a master–slave architecture, employing structured request–response messages known as Protocol Data Units (PDUs) to ensure organized and reliable data transmission. The BAN system is composed of wearable, microcontroller-based modules interconnected via the internal nBUS communication bus, with optional external interfacing to a PC for advanced data processing and visualization. Overall, nBUS offers a scalable, extensible, and robust foundation for sensor networks in wearable electronics, medical diagnostics, and experimental research. It enables flexible and high-resolution implementations of the BAN concept, supporting a wide range of real-time sensing applications.*

Keywords. Body Area Network (BAN), Wearable Systems, Communication Protocol, Real-Time Data Acquisition

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