e EMBEDOR TECHNOLOGIES

Xnode

Next Generation Wireless Smart Sensor

- **24-bit Data Acquisition**
- **High Sampling Rate (16kHz)**
- **Dual Core Operation**
- **Embedded Data Processing**
- **Environmental Rating: IP67**

The **Xnode Smart Sensor** is designed as the next-gen solution for high fidelity distributed sensing. This modular and versatile sensor platform enables wireless data acquisition and processing for data-intensive applications (high resolution, high sampling rate) such as structural health monitoring, manufacturing and industrial equipment monitoring, and seismic sensing.

Embedor's proprietary synchronized distributed sensing framework is capable of delivering precisely synchronized sensed data from thousands of distributed sensor channels. The wireless communication protocol between Xnodes and Gateways enable highly accurate time synchronization, under 50 microsecond precision, and ensures reliable, lossless data transfer under any operating conditions. Additionally, each Xnode can be configured as either a Sensor nodes or a Gateway, which coordinates and maintains wireless transmissions across a network of distributed wireless sensor nodes.

Powered by the dual-core ARM Cortex M4/M0 microcontroller at frequencies up to 204 MHz, the Xnode can execute on-board computation and data acquisition, which allows users to upload their own application for data processing (e.g., cable tension estimation, modal analysis, etc.).

Wireless Sensor Nodes **Gateway and Graphical Interface**

XNODE HIGHLIGHTS

- High precision 24-bit ADC with programmable sampling rate, cut-off frequencies, and digital filters
- Three-axes of acceleration, 3-channel strain, and internal temperature sensors
- Up to five external analog input channels
- Wireless communication at distances up to 1km
- Over-the-air reprogramming capability for firmware updates
- 4GB of external SD Card memory for data logging
- Environmentally hardened enclosure (IP67-rated)
- Fast and simple installation (magnet-, bracket-, or plate-mounted)
- Automatic wireless network configuration
- Synchronized wireless data acquisition from up to 250 Xnode Smart Sensors with 50 microsecond precision
- High-capacity rechargeable battery with support for solar panels and low-power operation

XNODE FEATURES

Xnode is a modular, environmentally hardened platform optimized for structural health monitoring. It features the NXP LPC4357 microprocessor that operates with ARM Cortex M4/M0 microcontroller at frequencies up to 204MHz, which can be used to execute on-board computation and data acquisition. The non-volatile memory available onboard is 32 MB of SDRAM as well as external SD memory up to 4 GB. The radio transceiver is a 2.4 GHz radio for low-power wireless communication (Atmel AT86RF233). Transmission distance reaches 1km line-of-sight with maximum transfer rate of 250 kbps.

The sensor board employs a 24-bit ADC (Texas Instruments ADS131E8) with 8 channels allowing maximum sampling rates up to 16 kHz. An ultra-compact consumer low-power 3-axis accelerometer (ST Micro LIS344ALH) is installed on the sensor board. The sensor node is packaged in an IP67 environmentally hardened enclosure.

APPLICATION

- Bridge Long-term Health Monitoring
- Cable Tension Monitoring
- Structural Stress and Vibration Measurement
- Characterizing Soil Condition

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SPECIFICATION[1]

General	
Sensor Input Channel	3-axis Acceleration 3-ch Strain 3-ch Analog Input (single ended/differential)
Internal Sensor	1-ch Internal temperature
Data Storage	Internal 32 SDRAM + External 4GB SD Memory
Analog Signal Acquisition	
Effective number of bits (ENOB)**2**	20 bits
Maximum sampling frequency	16 kHz
Input voltage range	0-3.3 V
Accuracy	0.04%
Acceleration Sensing	
Sensitivity	0.66 v/g
Acceleration range (selectable)	±6g, ±2g
Noise floor, Z axis	0.7 mg
Noise floor, X and Y axes	0.3 mg
Strain Sensing (350 ohm strain gauge)	
Noise floor	1 us
Sensitivity	4.76e5 us/V
Strain range	±700,000 us
Shunt Calibration	Internal shunt resistor of 100kΩ
Radio Characteristics	
Operating frequency	2.4 GHz
Transmission power	-17 to +4 dBm
Data rate	250 kbps
Maximum transmission distance	1.2 km
Communication protocol	IEEE 802.15.4
Operating Parameters	
Temperature range (default enclosure)	-20 to +60 C
Temperature range (custom enclosure)	-40 to +85 C
Internal power source	Internal 3.7 V DC, 10,000 mAh, rechargeable lithium polymer battery
External power source	5 V DC (USB or solar panel)
Physical Specifications	
Dimensions	150 x 70 x 50 mm
Weight	750 g
Environmental rating	IP67
Material	Plastic
Mounting options	Magnet (default), plate, bracket
Temperature range (with custom enclosure)	-40 to +85 C

[1] The noise floors were calculated on the frequency range of 0-20 Hz.

[2] Effective number of bits (ENOB) specifies the resolution of an ideal ADC that would have the same resolution as the circuit under consideration of actual noise and distortion.