Novel Wireless Network Architecture with Frame Aggregation Scheme

A system with unique power-saving capabilities that increases the quality and expands the capacity of wireless signaling for applications like subterraneous seismic surveying

Georgia Tech researchers have developed a method and apparatus for real-time seismic acquisition in high-density environments that includes both a novel network architecture and a frame aggregation power-saving geophone relay (FA-PSGR) scheme. The network architecture wirelessly connects geophones and the data collection center with IEEE 802.11ad standard compliance, which enables the transmission of data at high data rates—up to multiple gigabits per second. The concept of frame aggregation, however, can be more broadly applied to home and sensor networks with IEEE 802.11n and 802.11ac systems.

Thanks to the FA-PSGR scheme in this technology, the system uniformly conserves power, while allowing engineers to receive real-time data about the survey area and adapt accordingly. This setup also eliminates the need for costly cables and enables longer, broader, and more efficient surveying.

Summary Bullets

- **Innovative**: Addresses increased latency in the power-saving geophone relay scheme using an optimized frame aggregation analytical model
- **High efficiency**: Saves power with a carefully designed FA-PSGR scheme for extended survey duration
- **Intelligent**: Maintains real-time data acquisition by turning geophones on “sleep mode” during idle periods, reducing channel bandwidth

Solution Advantages

- **Innovative**: Addresses increased latency in the power-saving geophone relay scheme using an optimized frame aggregation analytical model
- **High efficiency**: Saves power with a carefully designed FA-PSGR scheme for extended survey duration
- **Intelligent**: Maintains real-time data acquisition by turning geophones on “sleep mode” during idle periods, reducing channel bandwidth
- **Streamlined**: Reduces the environmental, labor, and cost burdens otherwise present in a cable network
- **Low-risk**: Eliminates the risks of a widespread cable network such as manual troubleshooting in uneven terrain as well as animal and environmental interference

Potential Commercial Applications

- Oil and gas exploration
- Earthquake evaluation
- Landfill planning
- Engineering and environmental surveying
- Cellular backhaul

Background and More Information

Seismic surveys are used to determine the size and location of oil, gas, and other mineral deposits in the subsurface layers of the Earth. Geophones play a crucial role in the surveying process by recording the reflections of seismic waves on the area under Earth's surface. These geophones are typically connected to each other and the data collection center by cables, which necessitates a large equipment weight and cost as well as complicated and hazardous setup with recurrent troubleshooting. Georgia Tech's wireless geophone network architecture with high data rates and power-saving abilities is designed to cut costs, save time, enhance safety, and extend the lifetime of seismic surveys.

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Publications

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