

## Power-Saving, Data-Transmitting System for Wireless Remote Sensing

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Patent applied for.

**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a low-power wireless network system well suited to smart agriculture. By dramatically improving energy efficiency, this technology will allow for longer deployment of sensors without battery replacement.**

### OVERVIEW

Real-time data monitoring via wireless sensors is used in a wide range of applications, such as "smart agriculture," where sensors measure soil moisture and monitor livestock, and in health care, where wearable sensors monitor the vital signs of patients. Ideally, wireless sensors in remote locations must be capable of long communication range and low power consumption for a long battery life. However, there is usually a trade-off between range and power. Often this is managed by placing the transmitter into a low-power mode between transmissions. While this approach reduces average transmission power, it also limits the amount of communicated data.

### THE INVENTION

UW-Madison researchers have developed a low-power, wireless network system that conveys information in the time elapsed between two symbols (start and stop symbols). A transmitter transmits two (short) anchor symbols per message and encodes data in the time between the symbols, unlike other methods, which encode data in the symbols itself. This creates a shorter duration of radio on-time for any message length and reduces the power needed per message. In addition, the transmitter is always in sleep mode, including the time between anchor symbol transmission, i.e., it can be in sleep mode while transmitting data.

This modulation technique can be combined with other existing techniques to yield longer communication range and low-power consumption networks that scale extremely well. The improved system can provide as much as three times the energy savings over state-of-the-art LPWAN (Low Power Wide Area Networks) techniques such as LoRa, SigFox.



### THE WARF ADVANTAGE

Since its founding in 1925 as the patenting and licensing organization for the University of Wisconsin-Madison, WARF has been working with business and industry to transform university research into products that benefit society. WARF intellectual property managers and licensing staff members are leaders in the field of university-based technology transfer. They are familiar with the intricacies of patenting, have worked with researchers in relevant disciplines, understand industries and markets, and have negotiated innovative licensing strategies to meet the individual needs of business clients.



## BUSINESS OPPORTUNITY

LPWANs are expected to grow to a total market size of \$212M by 2023, with a compound annual growth rate of 25.9%. LPWANs create opportunities for end users by using little energy and having a low upfront cost. Companies such as SigFox and associations such as LoRa are developing low-cost, low-power, wide-area networks for the internet of things (IoT).

LPWANs are used in verticals such as utilities, agriculture, manufacturing, wearables and transport. This invention, by improving the energy efficiency, will allow for longer deployment of sensors without battery replacement or allow sensors to get power from ambient energy scavengers or other alternative sources.

## APPLICATIONS

- Network software and hardware for real-time data monitoring with long range, low power consumption and large scale.

## KEY BENEFITS

- Profoundly decreases energy consumption, allowing the network to easily scale
- Provides substantial range and collision avoidance in a multisensor environment
- Exploits the benefits of no-power data transmission using versatile carrier modulation and multibit anchor symbols
- Provides for ultra-low power and is easy to integrate with existing/off-the-shelf components

## STAGE OF DEVELOPMENT

This innovation could provide up to 82-fold improvement in energy efficiency compared to state-of-the-art LPWANs that provide comparable communication range and achieve an average collisions-per-node of less than 5 percent in a deployment with more than 1,000 nodes.

## ADDITIONAL INFORMATION

### Publications

[This technology was a 2019 WARF Innovation Award finalist.](#)

[WiChronos: energy-efficient modulation for long-range, large-scale wireless networks](#)

### Tech Fields

Information Technology - Network technologies

## CONTACT INFORMATION

For current licensing status, please contact Emily Bauer at [emily@warf.org](mailto:emily@warf.org) or [608-960-9842](tel:608-960-9842).