Researchers at Pacific Northwest National Laboratory developed a technology that will help decision-makers understand the impacts of wind turbines on birds and bats.

THERMALTRACKER-3D

Stereo-vision solution for tracking wildlife behavior around remote wind turbines

A POWERFUL TOOL FOR UNDERSTANDING RISK

ThermalTracker-3D, a novel technology developed at PNNL, is a stereo-vision solution for evaluating flight tracks of birds and bats around offshore wind turbines.

Using a pair of thermal video cameras, the technology remotely senses movement of animals and objects, day and night, near critical assets. It generates motion tracks by collapsing a sequence of video frames from each camera into a single image that contains an entire flight track and then applies stereo-vision processing to transform the flight track into three dimensions. The approach allows tracking in near real time and automatically identifies moving objects based on features from the motion track and object size.

BIRDS AND BATS COEXISTING WITH TURBINES

Offshore wind could potentially power millions of homes. But uncertainty surrounding how wind technologies affect bird and bat populations is slowing development and deployment of offshore wind farms. ThermalTracker-3D provides decisionmakers with vital information for evaluating and mitigating potential risks to wildlife.

TECHNOLOGY FEATURES

- Tracks movement with a thermal signature—whether animal or object—in real time

- Effective day and night and in low-visibility conditions

- Three-dimensional flight tracks provide accurate estimates of flight height for risk assessment

- Computationally efficient, real-time processing significantly reduces data storage and bandwidth requirements

- Motion track data is generated in an easy-to-use form that can be readily analyzed in any statistical or visualization software

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ENERGY

The easy-to-assemble technology uses a pair of thermal motion cameras to remotely sense movement of animals and objects in real time using a thermal signature.

A BIRD'S EYE VIEW—IN REAL TIME

ThermalTracker-3D is designed to provide data to help inform siting and permitting decisions for wind turbines, and it allows monitoring of bird and bat behavior following offshore wind farm construction to help fill gaps in the understanding of avian-wind technology interactions.

In real time, the software extracts flight tracks of wildlife from thermal video data and characterizes them by:

• time of day or night

• direction of travel

• flight height

• wingspan

• body length.

This information and other features inferred by the software, combined with historical survey data, can be used to determine which species of birds are active in an offshore area and where they are flying.

ThermalTracker-3D only saves data that contain flight tracks, reducing the amount of saved data to less than 1/300 of the raw video data. Once the video data are processed, the extracted flight track data are transmitted back to shore via a satellite link for analysis. The real-time processing enables users to place cameras in a remote location and record for months—without worrying about data storage running out.

UNLIKE ANYTHING AVAILABLE

Current monitoring systems are limited to daylight hours and/or generate massive volumes of data that are costly and time-consuming to store and analyze. To address these shortfalls, PNNL researchers developed ThermalTracker-3D software capable of computationally efficient, continuous monitoring of flying objects—day or night—and in any weather condition.

Another distinct feature is the technology's compact size, which makes it easily integrated with offshore platforms, such as a buoy, substation, or turbine platform. Other monitoring systems have a large footprint, consume a significant amount of power, and are very heavy.

In studies at PNNL using a pre-recorded data set, the ThermalTracker-3D software correctly detected 81 percent of the 184 flight tracks present in the data with a false positive rate of 17 percent. Human researchers took an average of five times longer to analyze the same raw video data.

ThermalTracker-3D can work with any thermal cameras that support the GigE Vision™ standard, and the output can be summarized and visualized with any statistical software.

INDUSTRY APPLICATIONS

Because ThermalTracker-3D can sense and monitor any object with an observable thermal signature, it can be used to monitor animal movement around critical assets, like wind farms. It also is suitable for long-term, continuous monitoring of airplanes and unmanned aerial vehicles—such as drones—at secure locations and/or in airspace over such locations.

AVAILABLE FOR LICENSING

The technology, developed with funding provided by the U.S. Department of Energy Wind Energy Technologies Office, is available for licensing in all fields of use. To learn more, visit availabletechnologies.pnnl.gov or contact our commercialization experts.

LET'S CONNECT

If you have questions, regarding this technology, please send inquiries to commercialization@pnnl.gov. You can view all PNNL technologies available for licensing at www.pnnl.gov/available-technologies.