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MARKET SHEET

Multi-frame Moving Object Detection System (MMODS)

MMODS offers a breakthrough in detection technology for moving objects to enhance real-time detection of low signal-to-noise ratio targets for improved surveillance

U.S. Patent No. - 11,188,750
Technology Readiness Level (TRL) 9

Business Problem

Traditional detection systems face significant challenges in identifying small objects in real-time, particularly in low-visibility conditions. These limitations hinder their effectiveness in security and surveillance applications, where the ability to detect potential threats is needed for ensuring safety and security. When targets are located far from the sensor, these systems struggle to maintain an adequate Signal-to-Noise Ratio (SNR), which is essential for distinguishing between the target and background noise. As a result, the monitoring process becomes increasingly complicated, leading to missed detections and delayed responses. This not only compromises situational awareness but also poses risks in scenarios where timely and accurate detection is critical.

Customer Need

A demand exists for advanced detection technologies that can accurately identify and track slow- and fast-moving targets across many environments, including urban settings, rural landscapes and challenging weather conditions. Customers require solutions that operate effectively without the need for prior knowledge of the environment, pre-labeled targets, or extensive training data, which can be time-consuming and resource-intensive. The ability to deploy such technologies rapidly in dynamic situations is essential for national security, law enforcement, search and rescue, military applications, and private security uses. Organizations need systems that can provide reliable detection in real-time, ensuring that even the smallest and least visible objects are identified and tracked effectively. This demand underscores the necessity for innovative solutions.

Sandia Approach

Researchers at Sandia National Laboratories have developed the Multi-Frame Moving Object Detection System (MMODS), which uses innovative signal integration techniques to process image streams from various sources through a computing station. By combining object detection with a dynamic motion estimation algorithm and breaking down traditional software development stovepipes, MMODS enhances target Signal-to-Noise Ratio (SNR) by intelligently matching and integrating signals over multiple video frames. This approach significantly improves real-time detection capabilities, enabling the identification of targets that are typically undetectable by conventional sensors due to low SNR.

Competitive Advantage

MMODS stands out in the field of detection technologies due to its unique ability to correlate and integrate signals across multiple video frames, which significantly improves the Signal-to-Noise Ratio (SNR) and enables the detection of camouflaged or low-visibility targets. This advancement provides several advantages over existing detection systems. Notably, MMODS operates effectively without requiring prior knowledge, pre-labeled targets, or training data. It can detect objects with a resolution as low as 1 pixel, allowing it to identify small targets that other systems may miss. Additionally, MMODS excels in detecting targets under poor visibility conditions, achieving reliable detection with an SNR close to 1:1. Its capability for real-time detection with modern megapixel cameras enables immediate responses in critical applications, while its ability to detect both slow- and fast-moving targets without introducing motion blur ensures accurate tracking.

Technical Benefits

- **Enhanced Detection Capabilities:** Identifies small moving objects often invisible to sensors and the human eye.
- **Real-Time Processing:** Enables immediate responses to detected threats, critical for security applications.
- **Innovative Signal Integration:** Enhances detection performance in low-light through advanced techniques.
- **Improved Detection Sensitivity:** Increases sensitivity by 200% to 500% compared to conventional systems.
- **Proven Reliability:** Successfully deployed in operational remote sensing systems.
- **Scalability and Cost-Effectiveness:** Supports easy hardware upgrades for larger frame sizes and more simultaneous trackable targets**.**
- **Future-Ready Technology:** Compatible with Adaptive AI Sensing Technology.

Industries & Applications

- National Security
- Law Enforcement
- Search and Rescue Missions
- Environmental Monitoring
- Defense and Surveillance
- Smart Cities
- Agriculture
- Traffic Monitoring for Autonomous Vehicles

Next Steps

Sandia is seeking partners to develop and commercialize this technology. For more information, please contact Sandia National Laboratories' Licensing and Technology Transfer office.

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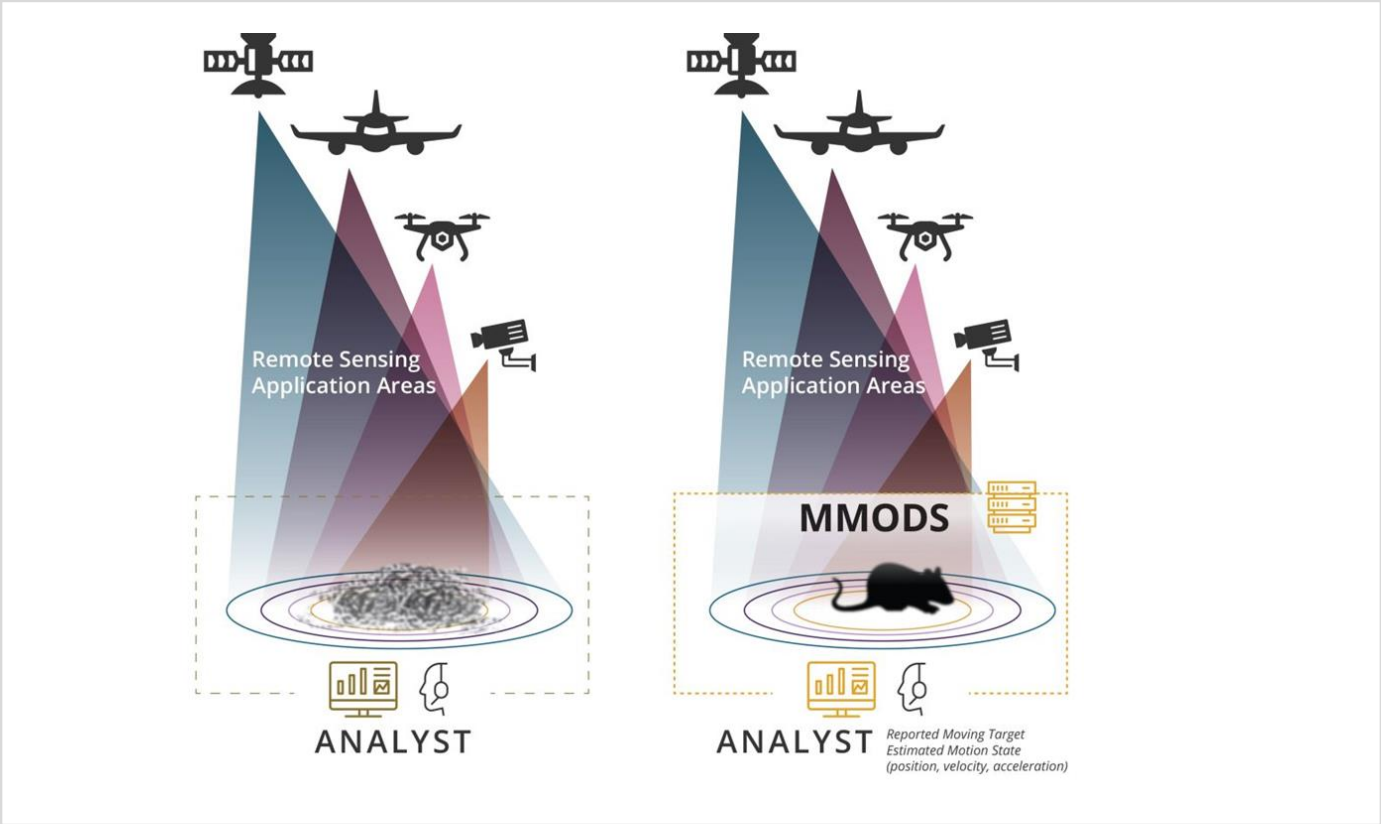
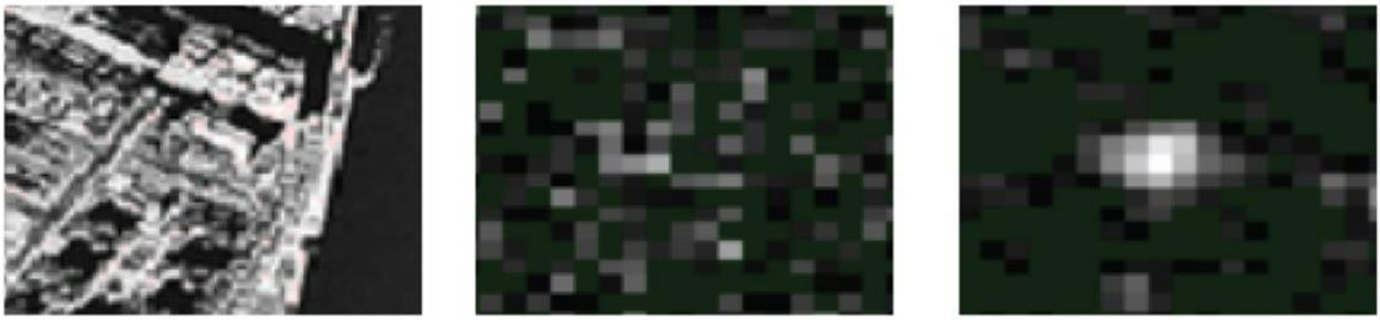
Technical Figures



Multi-frame Moving Object Detection System makes it possible for remote sensors to detect small moving objects that would normally be unseeable to both sensors and human eyes.



This image shows how running streaming data through Sandia National Laboratories' Multi-frame Moving Object Detection System makes objects that are otherwise unseeable possible to detect and track.