

## **A Novel Effective Smart Camera Based Machine Health Monitoring**

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### **Abstract**

Despite the rapid adoption of Industry 4.0 technologies, the full implementation of Condition-Based Maintenance (CBM) in critical industries remains a significant challenge.

Odysight.ai addresses this gap by developing advanced diagnostic and prognostic solutions that complement conventional vibration-based methods.

This work introduces Camera-as-a-Sensor™, a compact visual sensing system embedded with AI models, designed to operate in harsh and inaccessible environments. The technology has been successfully validated through deployments with NASA, U.S. government agencies, and various defense and industrial programs.

Artificial Intelligence (AI) plays a central role in modern Prognostics and Health Management (PHM) systems. This presentation highlights a novel hybrid physical-AI algorithm for real-time damage tracking in mechanical components, offering improved accuracy and scalability.

In addition, the Digital Twin (DT) paradigm is explored as a powerful tool for predictive maintenance. A recent case study in the railway sector demonstrates how synchronized physical and digital experiments can iteratively validate and optimize CBM strategies.

Collectively, these innovations represent a significant step toward building a scalable, accurate, and fully integrated CBM ecosystem, improving reliability, safety, and operational efficiency across critical mechanical systems.