4AI Systems

Object and Hazard Detection

Using Horus for the detection and classification of objects or hazards on or about the rail corridor.

INTRODUCTION TO HORUS

4AI Systems' forward-facing perception system called Horus collects data from multiple sensors including cameras, navigation systems, accelerometers, radar and more. This data is fused onboard in real-time to create a situational picture. This picture is then compared to the reference infrastructure data for each line to identify any differences.

The system may identify previously learned objects or alert a train operator that an unidentifiable object or hazard on the track has been detected. Horus has many capabilities that may apply to any vehicle that travels on a rail track, including real-time detection and recognition of objects and hazards.

CURRENT METHODS OF DETECTION

Identification of upcoming hazards and objects is core to safe operations. A train operator's ability to reliably see is often hampered by environmental factors including night-time, sun glare, low-light areas such as subterranean/metro tunnels, or during inclement weather conditions. Whilst these conditions may not stop rail services, the reduction or interruption in network performance may come at a significant cost to the communities they serve.

New advanced technologies can assist in providing a train operator with real-time information. For example, a thermal camera can detect any object with a heat signature, such as a human or animal in the Right of Way (ROW), or even the state of switches in night-time, poor light, or freezing conditions.

THE FUTURE OF OBJECT AND HAZARD DETECTION

4AI Systems has created Horus, a sophisticated vision and multi- sensor perception system, to aid train operator situational awareness and provide earlier warning to potential hazards in the ROW. The Horus SensorBar features a combination of calibrated colour and thermal cameras supported by multiple sensors in a pre-assembled array. Alternatively, Horus sensors can be embedded into the front panels of a rail vehicle cabin.

Horus uses proprietary software but aims to be hardware agnostic, with all sensors being commercial-off-the-shelf (COTS) equipment. Each sensor configuration is calibrated specifically for an operator's use case, can be swapped in or out, and replaced or upgraded as business needs and technologies evolve. Using COTS hardware allows 4AI Systems to offer a flexible deployment solution that meets the changing needs of operators and the technology market, without compromising system functionality.

HORUS CORE BENEFITS

+ **Object and hazard detection:** New sensor technologies are enabling the detection of objects in conditions not possible by a human, enabling alerts for earlier intervention.
+ **All-weather and light detection:** Horus and its sensors have been proven in use in poor visibility conditions such as low-light, glare, dusty, and inclement weather conditions.
+ **Flexible sensor configuration:** Sensors can be swapped in or out and replaced or upgraded as required for both operating purpose and as newer technologies become available.
+ **Accurate location reporting:** Configured as to the client needs and availabilities of technologies.
+ **Real-time onboard processing:** All detection and classification of objects is done onboard the train using ruggedised rail-rated computer loaded with the Horus processing software. Data connectivity is only used in specific use cases.
+ **Real-time infrastructure detection:** Horus can detect track objects such as signs, signal aspects, adjacent tracks, switches and points, and calculate distances to any detections.
+ **Train Control System (TCS) agnostic:** Horus is a supporting technology which can integrate with most modern TCS's or work as an independent overlay system. This is useful for trains traversing multiple networks.

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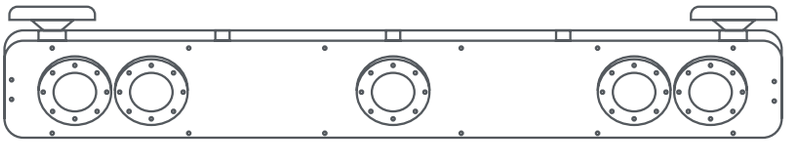
REAL-TIME DETECTION OF OBJECTS UP TO 2000M AHEAD

TRACK · SIGNALS · SIGNS · WORKERS · PEOPLE · ANIMALS · VEHICLES

SENSORBAR AND SUPPORTED SENSORS



SB HORUS SENSORBAR

COLOUR CAMERA · THERMAL CAMERA · GPS · INERTIAL NAVIGATION · RADAR

HORUS PROCESSING PIPELINE

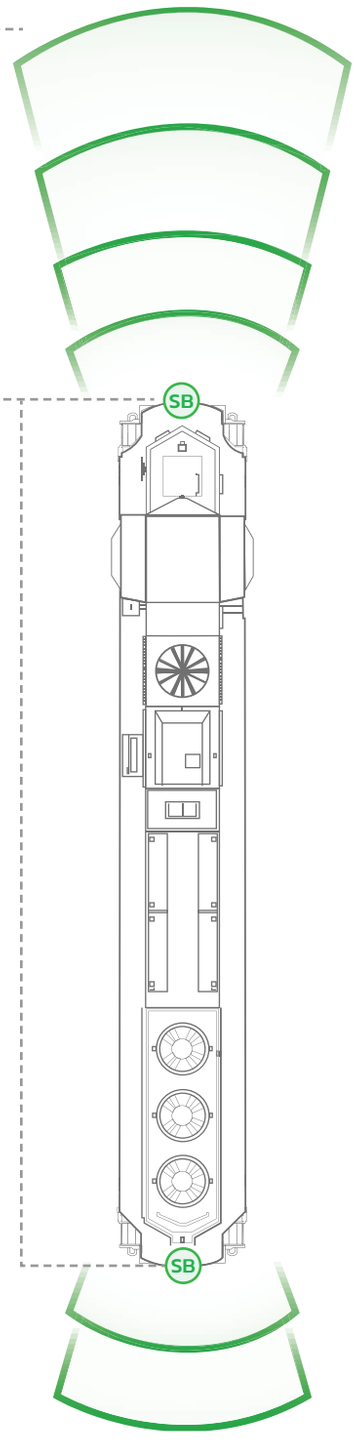
Detection
Using multiple sensors to understand the environment around the locomotive.

Localisation
Using what's measured to create a detailed localisation map.

Awareness
Interpreting the real-time virtual 3D environment around the locomotive for hazards, differences or anomalies.

Dynamics
Calculating optimal driving conditions within movement authorities given the infrastructure's condition, environmental conditions, and the train's dynamic characteristics.

Monitoring
Continuous checks are run to ensure the train is operating within its authority, and that the locomotive is operating normally.



ABOUT 4AI SYSTEMS

4AI Systems was founded in 2021 as a subsidiary company of 4Tel Pty Ltd, drawing on 25 years of experience in delivering industry-leading solutions to the rail industry. 4AI Systems builds machine learning vision systems that can empower people and organisations to make better, situationally aware, data-driven decisions for safer and more efficient rail operations. Based in Australia and the United States, we bring a global perspective to everything we do.

For more information visit:
www.4aisys.com
Enquiries:
info@4aisys.com

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