4AI Systems
Collision Avoidance

Using Horus to identify anomalies or hazards around the locomotive to detect potential collisions.

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 collision avoidance.

COLLISION AVOIDANCE TECHNOLOGY

The rail industry is now able to look to addressing and minimising collision incidents using the advancement of modern Artificial Intelligence (AI) computing methods and sensor technologies. Issues that can be addressed include misread signals, train over-speed, train operator distraction or fatigue, or environmental conditions that impact visibility for decision making.

Once a potential collision is detected, a customised configuration of these technologies can provide an alert to warn the train operator to take action or mechanically intervene if the train operator fails to do so within the pre-configured business rules. The response time will depend on factors such as visibility, environmental factors, the speed at which the vehicle is travelling, and its braking ability, to name a few.

HORUS FOR COLLISION AVOIDANCE

Horus is a specific solution using AI processing of sensor technology data to support rail vehicle operators by providing a highly accurate, independent location assurance system. Once location assurance has been achieved, the task of determining whether an object is in the right of way can be confirmed by comparing known track data against anomalies presented.

Acting as a never tired or distracted observer, Horus uses a combination of vision sensors to continuously monitor the environment around the locomotive in real-time to identify hazards or differences, and issues alarms or braking commands per network rules. Horus can detect objects in or around the rail corridor up to 2 kilometres / 1.24 miles ahead, subject to conditions, such as the object's size and camera quality.

AUTOMATIC TRAIN PROTECTION

When Horus is integrated with an EN4CER system, emergency braking can be automatically engaged (depending on network rules) via an independent SIL4-rated safety computer to create an Automatic Train Protection (ATP) system. Each ATP application does need to undergo functional safety assessment per train type, network and operation. 4AI Systems can provide this capability and has already participated in a functional safety assessment in a client environment.

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.
+ **Advanced Driver Advisory System (ADAS):** In-cab Human Machine Interface communicates the business-specific configured information to the Train Operator for response or actioning.
+ **Situational awareness:** Interpreting the train's real-time virtual 3D environment to determine its location/position in relation to its surrounds and cross-checking against its movement authority.
+ **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.
+ **SIL-certified braking relay (optional):** A braking interface for automatic braking of a train in case of failure to slow or stop. SIL accredited on a case-by-case basis.
+ **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.
+ **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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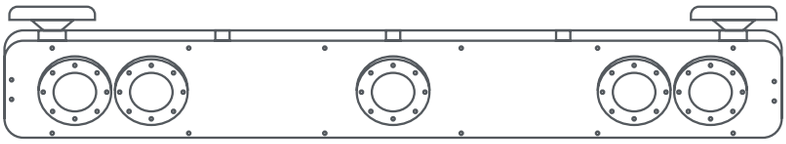
REAL-TIME DETECTION OF OBJECTS UP TO 2000M AHEAD

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

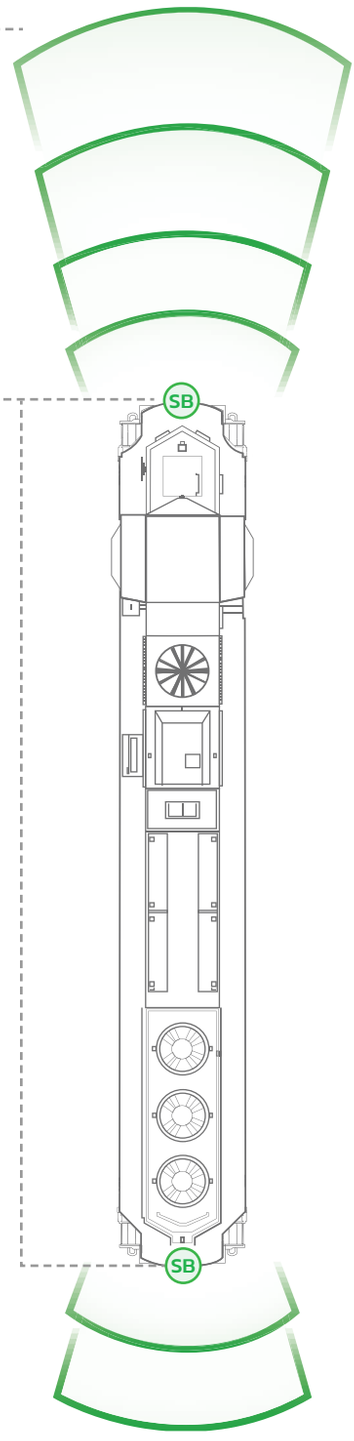
Detection
Using multiple sensors to understand the environment around the locomotive.

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:
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