4AI Systems

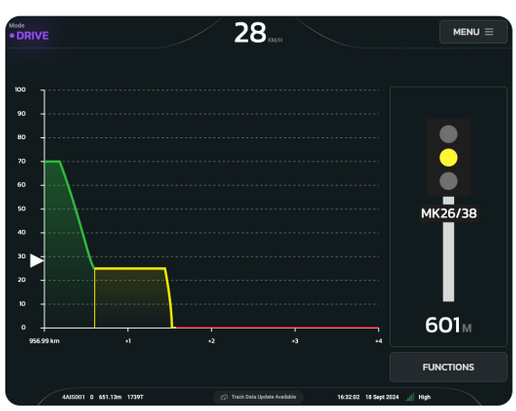
Authority Monitoring (Virtual Trip Stop)

Using Horus for the recognition and reading of displayed aspects to assist in the alerting of movement authority limits.

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 authority monitoring alerts for a virtual trip stop solution.



AUTHORITY MONITORING

Exceeding a limit of authority is a common railway problem. Many issues can occur from misread signals, train over-speed, train operator distraction or fatigue, or the environmental conditions that hamper the ability to see the signals, important track objects or hazards in time. To support the train operator, the Horus system can detect the signal aspect while also detecting other matters, such as speed and track objects (switch/points settings or mechanical trip stops for example) for presentation to the Train Operator Display in the cab. By assisting a train operator in the identification of signals and other infrastructure, at a distance, in all weather conditions, Horus acts as a never tired or distracted observer, reducing the chance an error or lapse in concentration can be made about a signal aspect, speed or track objects.

4AI Systems additionally has a separate integrable enforcement system called EN4CER. EN4CER can be engaged to brake the train to an approved braking curve for a given train configuration for automatic train protection.

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. This established and independently verified process enables faster deployment in other environments.

HORUS CORE BENEFITS

+ **Advanced Driver Advisory System (ADAS):** Automatically identifies signal aspects, speed, and track objects for drivers to maintain their limits of authority.

+ **Flexible train operator display:** A Human Machine Interface that keeps the train operator aware of upcoming signal aspects and braking curve. Displays are configured to business requirements.

+ **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.

+ **Onboard authority enforcement:** By cross referencing movement authority information with a train's route assurance capabilities, Horus can enforce authorities onboard a train.

+ **Wholly onboard system:** Process information in real-time, with minimal communications required.

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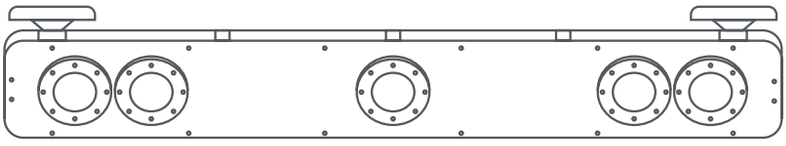
REAL-TIME DETECTION OF OBJECTS UP TO 2000M AHEAD

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

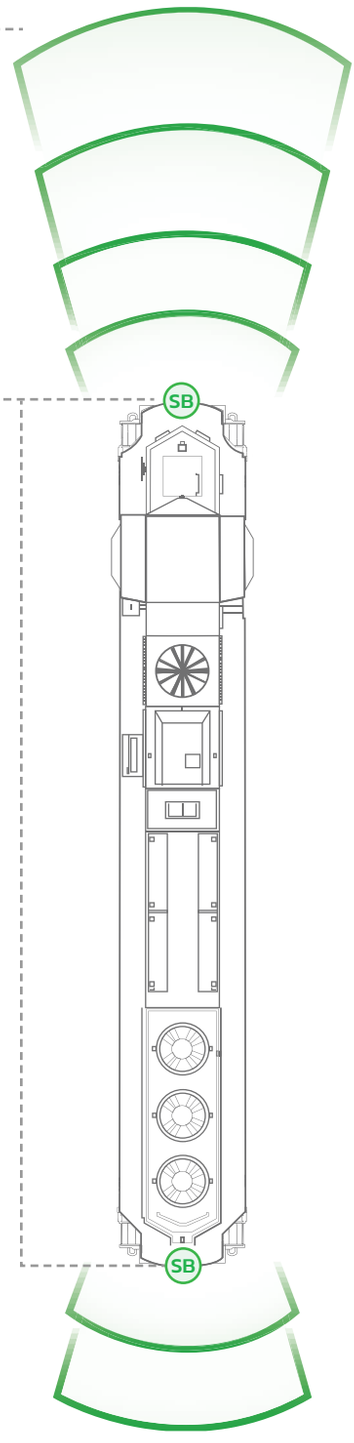
Detection
Using multiple sensors to understand the environment around the locomotive.

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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