GATEKEEPER SECURITY

GKH-TR11 – AUTOMATIC TRAIN UNDERCARRIAGE INSPECTION SYSTEM
Product Summary:

The GKH-TR11 Automatic Train Undercarriage Inspection Systems (ATUIS) is as the name suggests automatically inspects the undercarriage of a train’s rail cars. The system is embedded between the rail tracks in such a position to allow trains to pass over the dual or single view scanner so that the undercarriage of the individual rail cars is captured. Trains pass over the environmentally sealed scanner while Gatekeeper’s system scans and compiles one or two (depending on scanner type selected) high-resolution image/s of a train’s rail car undercarriage to create individual undercarriage digital “fingerprint/s”. An overview image of each rail car is displayed on a high-resolution monitor along with the resulting scans of the rail car undercarriage.

After each rail car has cleared the scanner, it will take 2 – 3 seconds for Gatekeeper’s Automatic Foreign Object Detection software to automatically compare the new scanned rail car image to a safe rail car undercarriage, stored in the database and display both on the screen. The system then immediately identifies any foreign object or modifications to the undercarriage by circling them with a red ring see below AND activating an audio and/or visual alarm.

The system can be integrated with tracking technologies such as automatic container number readers (ACNR) & RFID readers. The GKH-TR11 has such standard features as the ability to identify each rail car configuration and size, number of carriages in a train, date and time of the arrival of individual rail cars over the scanner, activity reports and in addition are network enabled requiring only to connect the systems to a common network for remote monitoring or operation.

Overview of Technology:

Below are the primary features & capabilities of Gatekeeper’s under vehicle inspection systems. In combination with these is the actual performance record of the Gatekeeper systems gained from deployment worldwide.

Core Technology – Gatekeeper’s technology uses Area Scan Image Processing technology which allows vehicle images to be normalized regardless of the speed of the vehicle as it crosses the scanning platform. Image capture and processing technologies such as recorded video streams, or line scanning processing are not capable of automatic identification and searching because they require the human operator to view/compare the images and decide if there is any object or modifications that could pose a threat. Live/recorded video and line scanning systems have been proven to be unreliable as an inspection technology due to poor performance and that they rely heavily on human knowledge, attention span and intervention.

Two Views of the Vehicle Under Carriage (virtual 3D images) – Gatekeeper’s systems compile two high resolution digital images of a vehicle under carriage and create a virtual “finger print” of the vehicle. Two independent views are necessary to provide the maximum amount of visual information to permit automatic identification and automatic searching. The two views or virtual 3D image makes it more difficult to hide objects, explosives etc on top of an axel or cross beam under a vehicle.

Automatic Vehicle Identification – Gatekeeper’s system uses the vehicle finger print to automatically identify the vehicle by matching the image against a data base of vehicle finger prints. The system does not rely on license plates or RFID etc to recall the vehicle from the database it is done via Gatekeeper’s patented pattern recognition algorithms. The two images are converted into a digital computer file and stored in a SQL data base where they can be matched against the entire data base. When a match is found the identity of the vehicle make & model can be (user defined) displayed on the operator terminal.
Automatic Foreign Object Detection – Gatekeeper’s system use Area Scan Digital Image Processing technology to convert vehicle under carriage digital images into computer files that are matched against a data base of known safe vehicle images. The Gatekeeper software automatically compares the subject vehicle to a safe vehicle and immediately identifies any foreign objects or modifications to the under carriage that may pose a threat. When a difference between the reference image and new scanned image is identified by the system it automatically places a red ring around the difference i.e. explosive or change to undercarriage etc and activates an audio and/or visual alarm to alert the operator of the threat.

System Performance Requirements

- Maximum Vehicle Speed – 20 Kilometers per hour
- Vehicle length: cars to very large/long trucks and train carriages
- Decision Response Time – (the length of time from when the vehicle clears the scanning platform until the system automatically identifies the vehicle, automatically searches the under carriage and displays the decision results on the operator terminal)
  - 4 - 5 seconds

Gatekeeper TR11 Specifications

Software Operating System

Automatic Foreign Object Detection System (AFODS)

- Patented digital “stitching” of continuous motion vehicle or rail car image to create high-resolution digital image regardless of vehicle speed up to 20 KPH
- Patented digital image algorithms automatically match scanned rail car “fingerprint” with vehicle database, detect foreign objects and provide audible and visual alerts to the operator terminal.
- Patented bi directional (contemporaneous dual inspection view – forward and backward) scanner providing a virtual 3D view of the undercarriage of a vehicle

- Operating System: Windows XPE
- Database: Windows SQL
- System Architecture: Open
- Online Assistance: Global Reach™
- Features: Patent Pending ability to Identify Vehicle/rail car models based on under vehicle image only.
- System automatically distinguishes between rail car types (tanker, flat deck, hopper etc) without operator assistance and produces composite stitched images of identical high quality without the need to adjust scanner settings or lighting.

Language: User defined – multi language GUI, Keyboard and LPR

SYSTEM PHYSICAL PROPERTIES

Embedded Frame

Unit mounts between the rail tracks and extends 35.5cm below grade. The embedded unit is poured on site and includes drainage and conduit exit points as per attached drawings. The site is isolated from the surrounding ground by the use of sheets of polycarbonate. The
system frame consists of a mounting platform suspended on 8 mounting rods that are attached to anti-vibration mounts. The light rails mountings are hinged and allow for adjustment of the light rails to match the viewing angle of the scanner.

Dimensions:

Length 168cm x Width 155cm x depth 35.5cm
Number of pieces: 4
Weight: 350 kg (approx)
Environmental: Galvanized steel

Scanner: Patented Design
Dimensions: 70 cm wide x 12 cm high x 1 meter long, 1 piece
Weight: 14 kg (approx)
Power Source: 24 VDC from Junction Box
Environmental: Sealed unit to protect against heat, dust, water and vibration.
Temperature range: -35c to 70c
Humidity range: 0 to 98% relative, non-condensing
Protection of scanner and light rails:

As trains often drag chains and other items below the rail carriages a special cover is included to help protect the scanner and light rails. It is mounted in such a way to deflect any dragging object.
Operating Environment

**Environmental**: Sealed unit to protect against heat/cold, moisture, sand, dust, oil, humidity and vibration.

**Temperature range**: -35ºC to 70ºC

**Humidity range**: 0 to 95% relative, non-condensing

**Viewing Angle**: Patented 2 high resolution images at 60 degree angles for maximum visibility into hard to see areas of a vehicle undercarriage. One looking forward and one looking backward producing a virtual 3D view of the undercarriage.

**Undercarriage illumination**: 6 x strips of High Performance programmable LEDs- lighting matched to scanner optimal light frequency. There are two shorter light rails on the external side of each track that can be adjusted to be angled up and toward the viewing angle of the scanner and then two longer light rails between the rails that can be adjusted to maximize illumination of the undercarriage.

**Scanning Camera**
- **Type**: Area Scan – high-resolution monochrome
- **Frame Rate**: 150 - 200 FPS
- **Connection**: Gigabit
- **Filters**: Band-pass

**Operator Terminal**
- **Indoor Operator Terminal**:
  - **Screen Type**: 48.26 cm Flat, Color Screen
  - **Resolution**: 1280 x 1024
  - **Temperature range**: 30c to 50c
  - **Humidity range**: 0 to 90% relative, non-condensing.

**Rack mount server**:
- **Processor**: Intel Core Duo 2.0 GHz
- **Memory**: 4.0 GB of SDRAM250
- **Storage**: 500GB HD (larger HD Optional)
- **Connections**: 2 Ethernet, 4 USB, DVI and printer ports.

**Rail Car Camera**
- **Type**: IP camera – Color VGA - Optional 3 Megapixel IP Camera
- **Sensor**: Sony CCD Image Sensor
- **Lens**: Auto Iris, 5/50mm lens
- **Filter**: IR Cut
- **Video Compression**: M-JPEG
- **Resolution**: 720 x 480 NTSC
- **Frame Rate**: 30 fps at 720 x 480
- **Protocol**: TCP/IP
- **Enclosure**: Optional environmental controls for temperature in extreme climates.

**System Trigger**
There are two system triggers required to control the GKH-TR11 – one when the train is first detected and then a second as the end of each carriage in the train is detected. These triggers are laser line of sight triggers.
SYSTEM PERFORMANCE PROPERTIES

**Max Vehicle Length**: 25 – 30 meters standard – longer vehicles can be scanned requires setup.

**Vehicle Width**: 2.75 meters standard – wider vehicles w/optimal settings.

**Max Vehicle Speed**: 20 Km/hr

**Networking**: Two operational modes – stand alone or networked. Networking via CAT6 Ethernet local area network or wide area via Internet connection. Optional fiber optic cable connection for longer distance. Server(s) and additional data storage required for larger networked applications.

**Automatic Alerts**: visual alert on the operator terminal when system detects foreign object. Watch List can be created to automatically alert the operator when a vehicle of interest image is detected.

**System Maintenance**: The system is designed for fast, simple replacement of components and remote diagnostics via Internet connection to facilitate a low level of down time.

**System Manuals**: The system comes complete with assembly/installation and operating manuals.

**Training**: Full training is available to all staff operating the equipment at the quoted rates.

**Warranty**: 1 year warranty on all system electronics.
Operator Screen

Rail Car Scanning
Top view of Rail Car Scanning Process

Scanning Hopper Rail Car
Rail Car Images