

Tunnel Scan

System Description



V 1.0 20160707

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1 Introduction

Most of the rail tunnels require inspections and routine maintenance in order to extend the life of the structure and render its use more secure . The typical external control of the tunnel wall is conducted mainly by human. Since these control routine requires a great expenditure of human labor and the block of the movement in the tract of interest , a more robust and automated control system is always longer be necessary . With this system you can capture detailed images of the entire tunnel by simply clicking a button

TUNNEL SCAN	
Max Acquisition Speed	50 Km/h
Longitudinal Resolution	Up to 0.5mm
Transversal Resolution	Up to 0.5mm @ 7 meters
Power Consumption	3000W
Section Analyzed	210°
Camera Type	High speed digital line cameras, monochrome, up to 12Khz
Measured pixel per section	32768 pixel
Lighting system	16 High Efficiency Led Illuminators
Temperature operative range	Min : -10 °C Max : +45°C

DESCRIZIONE SISTEMA



Figura 1: Example of Installation



Figura 2: Vehicle on the entrance



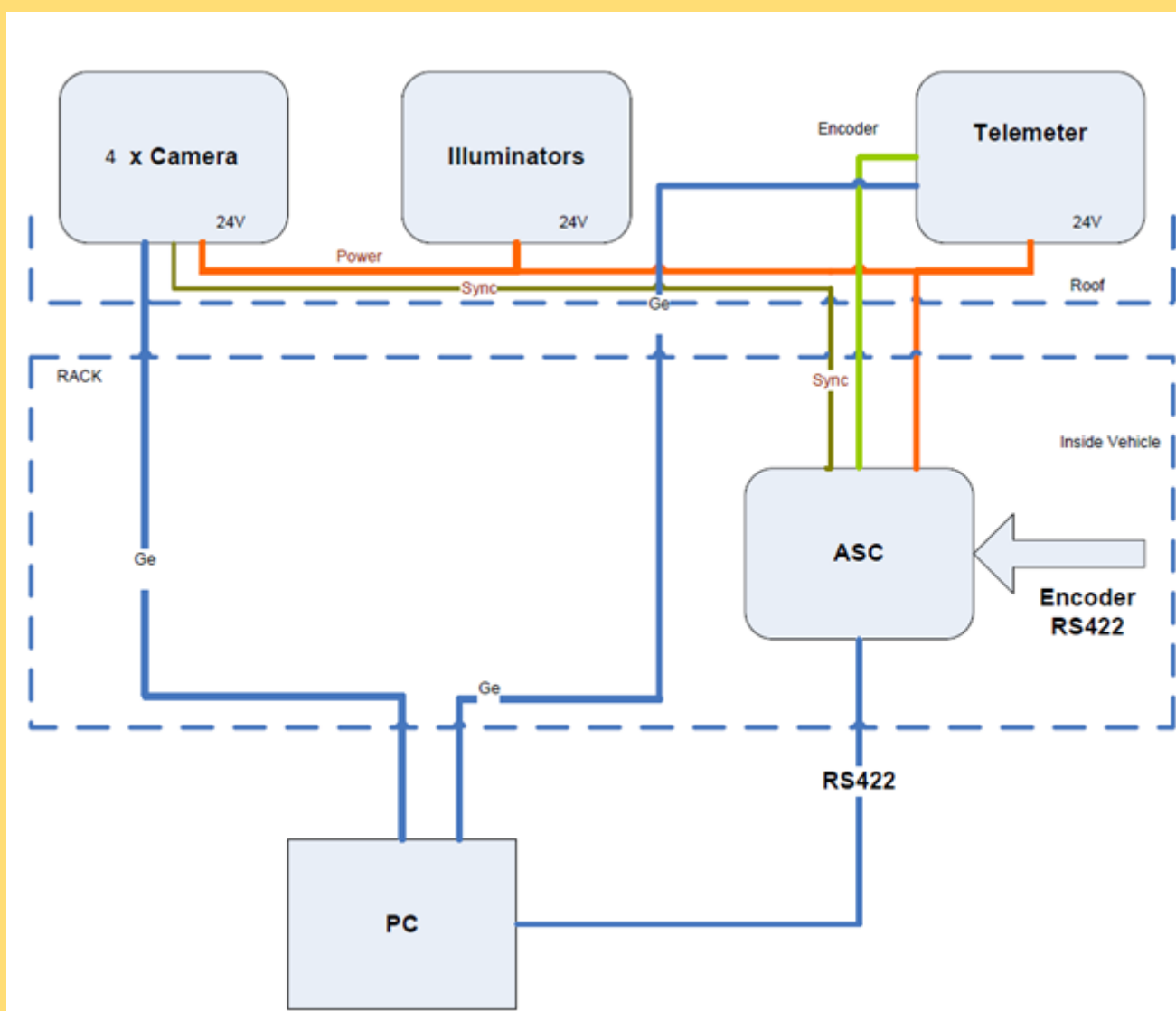
Figura 3: Light on the inner wall of tunnel

2 System Composition

The **Tunnel Scan** system is composed by 5 sub-systems:

- General Layout
- Illumination System;
- Clearance System;
- Image Acquisition systems;
- Compensation Systems;
- Control system and sync generator;

2.1 General Layout



An high resolution encoder is plugged to ASC. The ASC is a sync generator able to generate pulse up to 0.5mm. At each pulse the camera grab an image and the computer store the image with additional information such as kilometers position, GPS information, clearance information and other useful information.

The illuminators are controlled by a new device who allow the software to control the intensity of lamination and the health state of illuminators.

2.2 Illumination System

A group of 16 illuminators seats in a radial pattern at predetermined angles in front of the vehicle allow to evenly illuminate the vault of the tunnel . See Fig 1.

An electronic system allows the brightness control of each illuminator in order to provide a constant image brightness during the vehicle acquisition.

Illuminators absorb total 1600W and emit a white light .

2.3 Clearance System

A rangefinder can be integrated into the system . The range finder provide the tunnel profile and allows you to calculate the size of the defects that are acquired by the camera system . In " Figure 4 : Fault measurement" can be displayed when the fault begins and also ends when there are more dimensional information such as width, height, length and area.

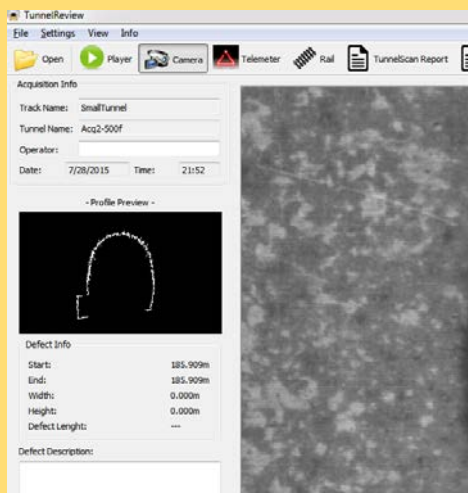


Figure 4: Fault Measurement

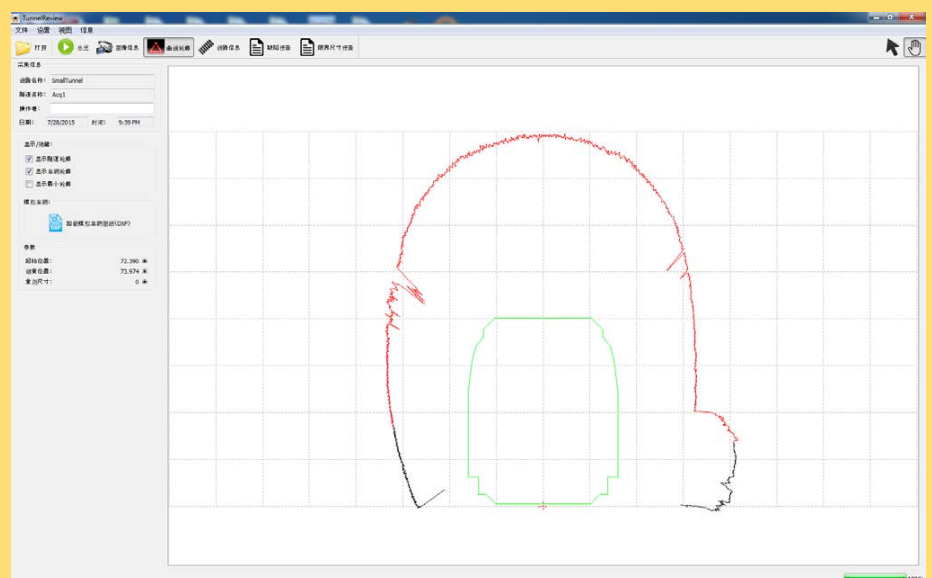


Figure 5: Acquired Profile

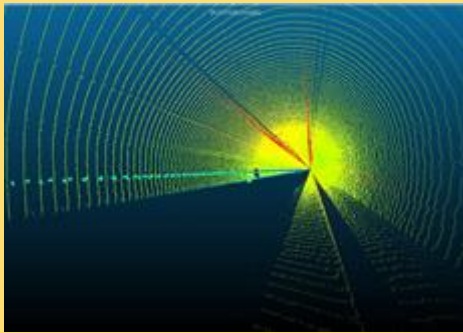
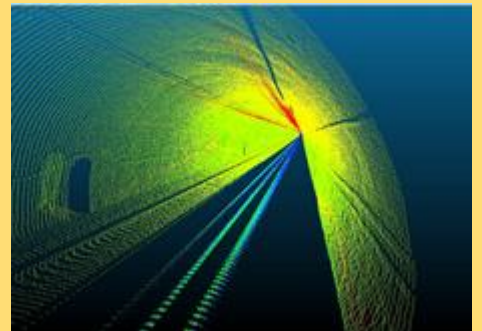
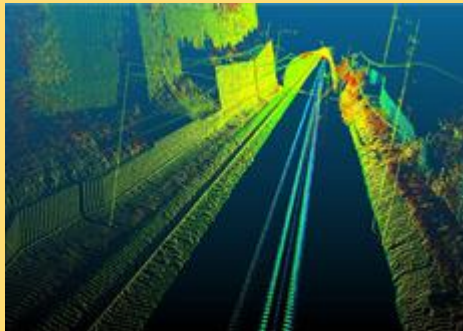
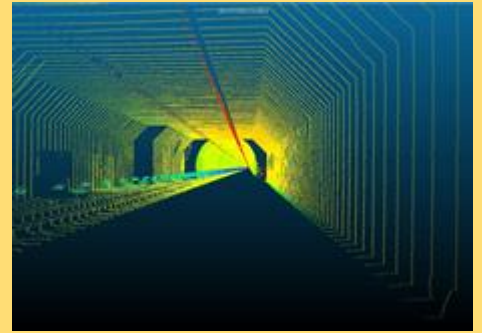


Figura 6: Profiler System



2.4 Image Acquisition systems

A group of 4 line cameras synchronized with each other are able to capture images in 12Khz each . The linear cameras with 8000 pixels and Giga Ethernet protocol sends all the data to a PC able to save all the images in real time . A synchronism generator is capable of providing acquisition pulses every millimeter .

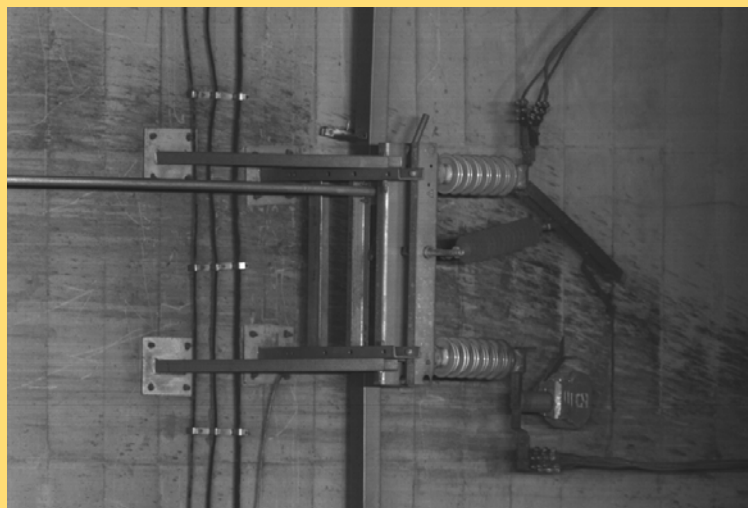


Figura 6: Acquisition Detail

2.5 Compensation System

In the presence of curves, the vehicle tends to incline in this way, the acquired profile begins to rotate because drive to the vehicle . A compensation system consists mainly of lasers to measure puts the inclination of the vehicle and then " straighten " the scanned profile.

A compensation system can be composed of simple laser pointers , cheap but unreliable or laser - triangulation camera systems .

2.6 Control system and sync generator

Inside the cabin it will install a rack, in the rack will be placed industrial PC , power supply , synchronism generator . A table with two stations are required to monitor the functionality of the system .



Figura 7: Computers inside Cabin



Figura 8: Electronic Rack

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