Augmented Reality Technology Applied to a Remote and Reliable Maintenance Support

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NEM SOLUTIONS

Dedicated to improving the effectiveness and efficiency of maintenance and asset management

MOBILITY

ENERGY

TECNALIA

- TECNALIA Research & Innovation is a private, non-profit research organisation, operating in the fields of Industry and Transport, ICT, Sustainable Development, Innovation Systems and Health and Quality of Life.
- Leading private research and technology entity in Spain and the 5th largest in Europe.
- Formed by merger of 8 research centres: Cidemco, ESI, EUVE, Fatronik, Inasmet, Labein, Leia and Robotiker

tecnalia Inspiring Business

AUGMENTED RELIATY AND THE RELIABLE MAINTENANCE

- Augmented Reality (AR) is a variation of Virtual Environments (VE), or Virtual Reality
- AR allows the user to see the real world with virtual objects superimposed upon or composited with the real world
- AR supplements reality, rather than completely replacing it

- By means of such technology, **maintenance tasks** and **operation incidents** can be supported, increasing the **reliability**:
  - Providing meta-information of interest to worker, associated to a component or a piece of equipment

The work presented in this paper forms part of the FP7 EU funded project **ManuVAR**: www.manuvar.eu

BUSINESS CASE – Reliable maintenance for LCC reduction

- High cost associated with the Operation and Maintenance of assets that require high levels of availability, reliability and safety

- Long expected life: High speed train-30yrs, Wind Turbine-25yrs
- Maintenance costs are often underestimated:
  - Optimism of designers/developers
  - Bespoke/new technologies
  - Competition between manufacturers

BUSINESS CASE – Reliable maintenance for LCC reduction

Cost estimation of **planned** maintenance is straightforward.

- Routine inspections, tests, cleaning/lubrication, part replacement

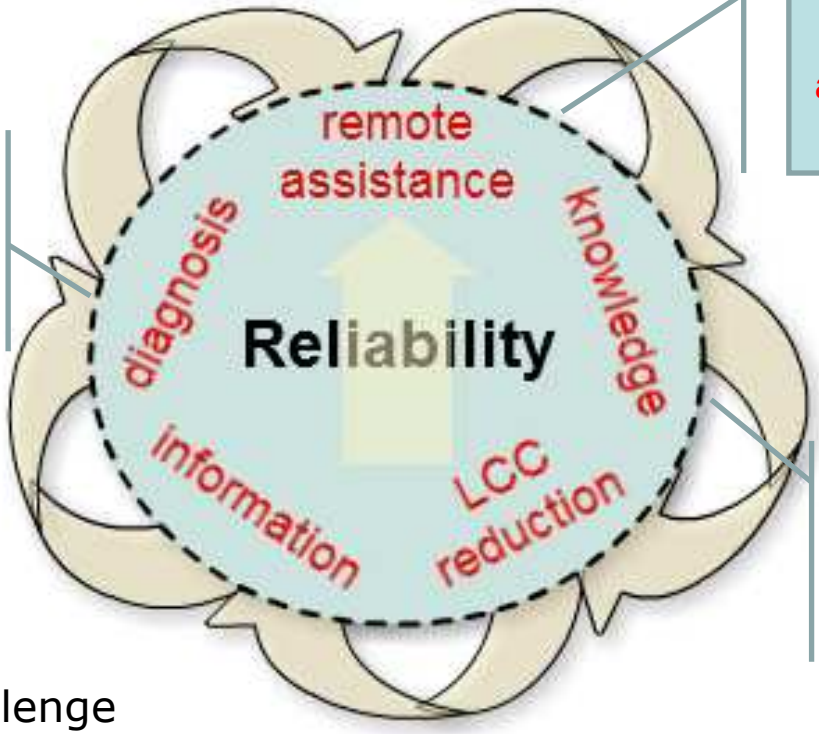
Costs associated with **corrective maintenance** and **operation incidents** are difficult to predict and can be extremely high:

- Cause for failure not known: diagnosis required
- Difficulty in reaching the asset
- Appropriate technical specialists not available to travel
- Warranty breach – penalty costs
- COST OF LOSS OF REVENUE (production / services)

THE CHALLENGE

To design a support system for corrective maintenance to increase the reliability and, consequently, reducing asset downtime, improving staff skills and reinforcing the knowledge transfer

CONCEPT

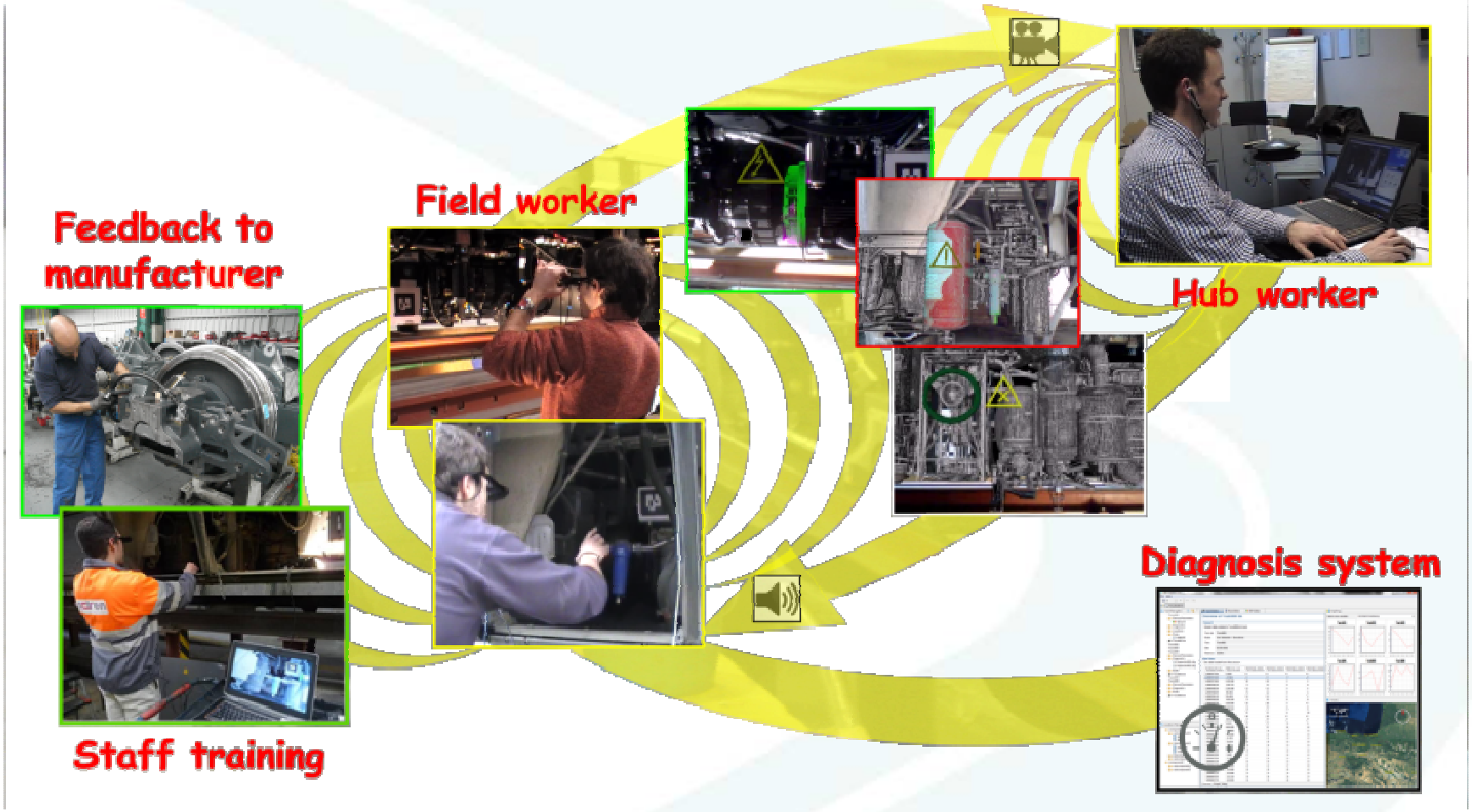


Platform for equipment experts to provide **remote assistance** to field workers at the site of failure

Provide **diagnostic** support through transfer of **information**

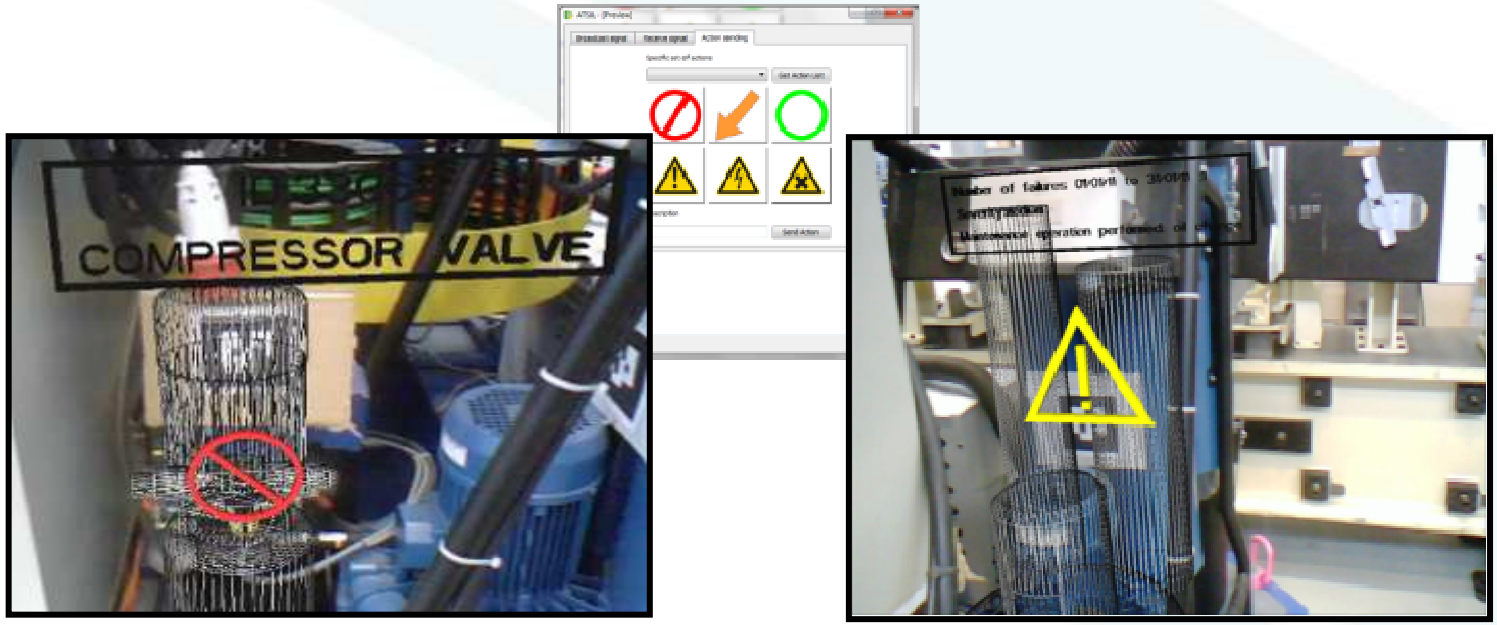
Provide **feedback** for staff training and knowledge capture

DESIGN....


Feedback to manufacturer
Field worker
Hub worker
Diagnosis system
Staff training

...Symbols for Warning and Information

Before: Difficulty in identifying specific parts. Unawareness of proximity of hazards



After: Warning signs and information symbols displayed directly through goggles, highlighting areas of interest or safety hazards

... Information for Diagnostics Support

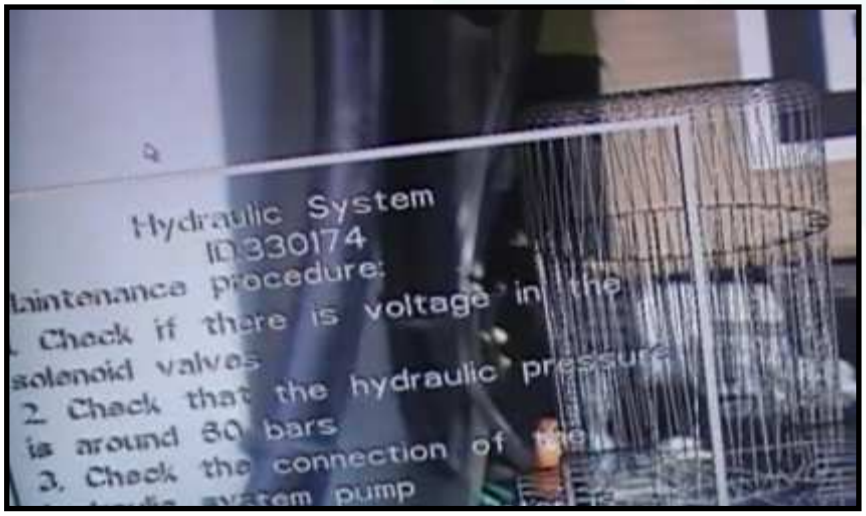
Before: Little or no diagnostics and equipment information made available to field worker. Only accessible via laptop (if lucky), dictated via phone, or on arrival of expert support

Key equipment data and diagnostics information displayed....

After: Knowledge available to field worker almost instantaneously and displayed for the specific parts being viewed.. E.g. Date of last inspection, Hours in operation, serial number, previous date of repair, vibration levels of most recent activity, etc.

...Display of Maintenance Instructions(MI)

Before: Maintenance instructions available to field worker through a laptop computer, or dictated over the phone. Only printed on paper if lucky to have chosen previously the required task to resolve the failure.



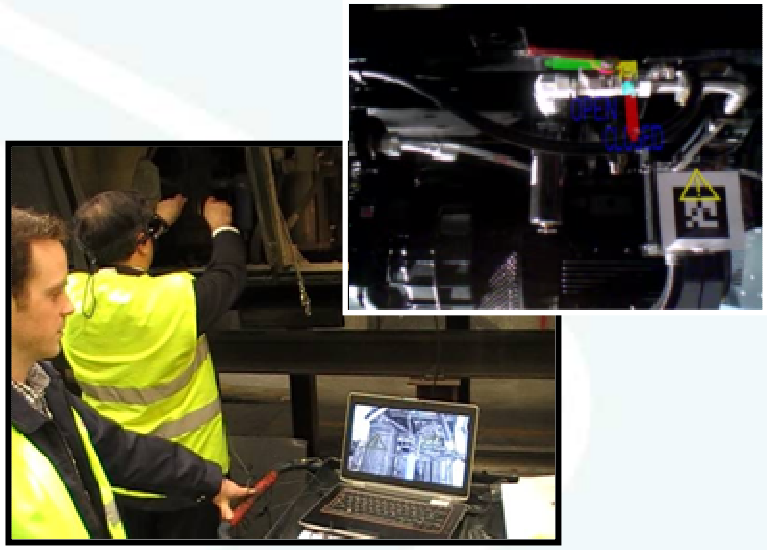
MI and procedures displayed directly through goggles....

After: Worker can operate hands-free whilst viewing and following the MI steps carefully. Back-up support from hub worker who can see the tasks being undertaken.

...Recorded sessions for Staff Training & feedback to manufacturer

Before: Theoretical classroom-based training for resolving corrective maintenance issues. Lack of feedback to manufacturer regarding the maintenance operations performed.

Video capture of fault finding, asset diagnosis, and repair work....



After: Mixture of theoretical training with real practical examples from the field. Feedback of interest to manufacturer to improve further designs of the equipment.

DEMONSTRATION AND RESULTS

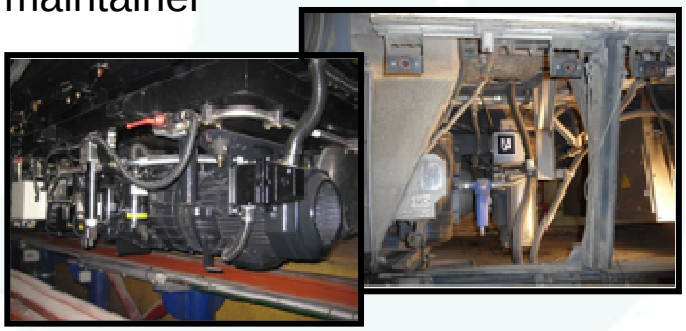
Technological trials:

Finland

Spain

Real demonstration in the railway vehicle maintenance sector:

CAF: train manufacturer and maintainer
ACTREN: train maintainer



The **air compressor**, a rotary screw type

DEMONSTRATION AND RESULTS

- ✓ The application could be used across function within the business such as production, component design, corrective maintenance, preventative maintenance and training (at all levels).

- ✓ The biggest impact is communication which will have a knock-on effect in driving down costs:
  - Reduction in time to diagnose and resolve maintenance issues
  - Reduction in diagnosis errors
  - Reduced travel costs for experts
  - Increased reliability in service
  - Better service to client

- ✓ Using this application will result in more effective training with greatly improved standards in the quality of maintenance across the business at far reduced costs

FUTURE WORK

- Transition towards ‘hybrid’ and eventually marker-less tracking, however, lighting and environmental conditions provide a challenge

- Work required to quicken the process to calibrate 3D data overlay when employed on a new asset part out in the field.

- Further testing of goggles and solutions new to market

- Refinement of calibration to ensure best ‘overlay’ of real and projected video streams (difficulty in accuracy over a distance range of 0.5m to 5cm)

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