AREA/AMRC Workshop
Use Case Examples

1. AR for Training

Overview of use case

The AR solution provides trainees with an augmented view of the physical product to accelerate learning and improve retention. The solution provides contextualised information in appropriate locations relative to the physical product. Such information includes:

- Product information (correct settings, etc.)
- Digital assets (3D models, textual explanatory information)
- Processes (step by step instructions on how to perform a task)
- Audio (talk track assistance)
- Questions to test the trainee's knowledge
- Tasks for the trainee to perform (potentially with smart tools and visual monitoring)
- Alerts to test responses to different events
- Live or simulated product IoT data
- Instructions to the user (where to stand, etc.)
- Feedback on trainee's performance (at the right time and location)
- Capture of trainee performance
- Closed loop analytics (time, accuracy and other metrics)
- Ability to seek remote assistance to help during training when required.

The maturity model of this use case will vary according to need and availability of the requisite data types.

Problem statement

Training of staff to manufacture, service or operate complex machinery often incurs significant costs owing to the difficulties of providing the right information at the right place and time on the product and the need to provide human trainers at that location.

Traditional methods (involving books and digital media) are, by definition, entirely separate to the product on which the person is to be trained. Moreover, often training material has large amounts of text which needs localisation to support international training networks.

Such non-connected methods present challenges in information retention.

Current Process

User reads/consumes training asset content (which may be paper manuals or digital instructions) and attempts to perform task. User must locate correct place on physical product whilst remembering the task from the (now out of context) training material.

User will manually select/check an option to state task completion. User receives little feedback on how well the task was performed (other than from human trainers).

AR-enabled Process

The AR solution provides a richer set of information, in context, to the user.

Using an appropriately enabled device (which may be handheld or wearable eyewear) the user is taken through the training scenario. Explanatory information is provided (texturally or audibly) in addition to

graphical information to demonstrate to the user where to stand and where to locate a specific position on the product.

Using on-screen instructions, the user performs the set of steps using the on-screen assistance. The system validates that the task has been performed correctly (via product digital feedback or visual inspection). Real or simulated IoT data may be displayed on the AR display to assist the user in the accuracy of their operations.

When the tasks are complete, the system stores the performance metrics (for subsequent aggregate analysis) and delivers a report to the user.

Benefits from use of AR

Reduced costs by decreasing amount of text to be translated.
Improved training time owing to contextualised instructions and more rapid assimilation of instructions.
Reduced costs of training in multiple (computer generated) anomalous task scenarios.
Streamline the training process for operators of complex equipment
Ability to train safely on otherwise hazardous, expensive or dangerous tasks.
Ability to train on exact configuration of product rather than on a "generic" configuration.

Stakeholders

Training managers, VP of manufacturing, VP of service

Example usage

Source : NLR

2. AR for Inspection and Quality Assurance

Overview of use case

The AR solution provides technicians with a solution to enhance the accuracy, efficiency and traceability of inspection tasks.

This use case has applicability in multiple domains and is presented here in a non-specific domain context.

With the ability to overlay digital content over the user's view of the world, the AR solution can provide the technician with the ability to:

- Check the presence of the correct physical components
- Validate the correct location of physical components
- Display real-time data overlaid over the view of the product to validate critical performance or operating characteristics
- Find the appropriate location on the product where to perform a check

- Capture imagery, operation and task end state for system archiving and traceability
- Present interactive checklists
- Present alerts to report anomalous or incorrect states

The maturity model of this use case will vary according to need and availability of the requisite data types.

Problem statement

Quality assurance and inspection tasks are often subject to human error with potentially negative outcomes such as equipment failure, injury, environmental pollution, cost and brand damage.

Current Process (optional)

User performs visual or other inspection tasks from checklists (or memory for frequent and repetitive tasks).

The user is typically presented with a checklist to ensure correct settings, correct parts are fitted, product operates correctly, etc.

AR-enabled Process

The AR solution provides a richer set of information, in context, to the user.

Using an appropriately enabled device (which may be handheld or wearable eyewear) the user is taken through the inspection scenario. Required settings, state, location, parts, etc can be presented to the user and automated visual confirmation can check that the inspection criteria are correct.

Additional on-screen information can be provided (texturally, graphically or audibly) to highlight where further action may be required. The interactive checklist can be provided in a hands-free mode and such augmentations are overlaid in the exact location where the check is to be performed on the physical products. The use of computer vision techniques can provide a level of certification for product checks.

Data captured from the product during commissioning checks can be displayed in context and compared to expected values, with anomalous values generating easy to recognise alerts for the user.

When the tasks are complete, the system can store the inspection values and states for subsequent traceability, if required.

Benefits from use of AR

Reduced inspection errors due to human error.
Improved reliability of inspection tasks enabled by visual automation.
Accelerated learning for new staff by interactive assistance for the checks.
Automated storage of inspection results for later traceability.

Stakeholders

VP of manufacturing, VP of service, VP of Quality

3. AR for Complex Assembly

Overview of use case

Sequence of steps (instructions) appear on operator's display in context with components in the work space, leading to the successful (first time) assembly without requiring reference to technical documentation other than that provided in AR view. When the operator believes the assembly is finished, the AR-assisted system confirms task completion.

Problem statement

Complex assembly involve more (and more unique) steps than can be remembered without failure. Also, some assemblies are unique (customized). Without AR, the operator must repeatedly mentally transform what appears on a support other than the actual objects that are being assembled (e.g., screen, paper), requiring memory and subject to interpretation.

Current Process (optional)

User reads/reviews step. While holding the described step in memory, looks at the components and performs the step. Returns gaze to the instructions to verify that the procedural guidance (instruction) is entirely consistent with that performed

AR-enabled Process

User's gaze is on the target (object) while the instructions appear in overlay, tracking the target while the operator performs tasks. As a task is completed, there is a visual confirmation and the next step is presented until the procedure is finished.

Environment

Usually an enclosed (indoor, sheltered) space, in which there are tools and parts. Space is modular (can change from time to time) to accommodate an array of products and/or stages of product assembly

Digital assets

Text, line drawings, animations, alerts. Files (graphics, data, etc.) with which the operator may interact

Benefits from use of AR

Need to transform instructions and remember them is removed.

Stakeholders

Production designers and managers, writers of technical documentation, operators

Examples

Boeing Wire Harness Assembly	https://www.boeing.com/features/2018/01/augmented-reality-01-18.page
Upskill case studies/use cases	https://upskill.io/skylight/functions/manufacturing/
GE	https://www.ge.com/reports/looking-smart-augmented-reality-seeing-real-resultsindustry-today/
	https://hbr.org/2017/03/augmented-reality-is-already-improving-workerperformance
Projection Works case studies	https://delta-sigma.updatesfrom.co/wp-content/uploads/sites/52/2016/03/ROI_The-Application-of-AR-on-ComplexAssembly.pdf

4. AR for Remote Assistance

Overview of use case

Two or more people are able to communicate in real time using digital tools and physical world places and/or objects as the "canvas" or subject.

Problem statement

When a person does not have the knowledge (experience, training, etc.) to perform a task, they have to choose from options that can be costly or delay achievement of goals.

Current Process (optional)

Without AR, the options for a professional confronting an unfamiliar situation include: call a technician with expertise/experience on the phone and describe, using voice and photos, the situation. The expert has to describe the solution and steps for remediation, without seeing the environment of the person they are trying to support. Other options include leaving the site to get written (or digital) instructions, waiting until an expert travels to the place or object, or taking the object to an expert.

AR-enabled Process

With AR, the person with less experience can perform the steps under guidance in real time. In effect, the AR device is the eyes and ears of the expert and the professional on site acts as the surrogate body (hands) of the expert.

Benefits from use of AR

The remote assistance use case helps to save (avoid) expert transit time to site, to better distribute the knowledge of a mature professional who, for a variety of reasons, may be unable to access workplaces.

Another benefit is that lower skilled professionals can be in the field without being accompanied by a senior craftsman but still able to complete tasks for which they are not trained in advance.

Digital assets

What digital data is required or assists this use case (e.g. 3D models, drawings, documents)

Environment

Anywhere indoors or outdoors. Frequently but not always in isolated or dangerous places. The tools and materials available to the on site professional may be unfamiliar or limited (by comparison with those available to an expert).

Stakeholders External Links or Examples

Vital Enterprises' SmarTech	https://www.vital.enterprises/blog/post/171981422142/scm-rolls-out-smartechpowered-by-vital
Vuforia Chalk	https://chalk.vuforia.com/
EON Reality AR Assist	https://www.eonreality.com/platform/ar-assist/
Hitachi Solutions Remote Assistant	https://us.hitachi-solutions.com/resources/augmented-reality-remoteassistance-field-service/
Scope AR Remote AR	https://next.reality.news/news/scope-ar-merges-its-ar-workflow-remoteassistance-functions-into-one-app-0185032/
Apprentice	https://apprentice.io/products/

5. Virtual User Interfaces with AR – Overview Use Case

Overview of use case

A network-connected physical world object without a physical user interface can be evaluated (information about its current or past status observed) and parameters adjusted or controlled by an AR-assisted professional

Problem statement

For a variety of reasons, some network-connected machines do not have any or full user interfaces. The user that is near (in front of) the object is unable to obtain current status and reports, or to make any adjustments or control the object's settings.

Current Process *(optional)*

Without AR the professional in front of the machine must communicate with or personally go to a control center make any adjustments or control settings. This requires time and/or may result in confusion about which machine in the field is being controlled from the central point.

AR-enabled Process

A user can see appropriate interfaces without going to a remote panel. Modifications/adjustments can be made while next to/in front of the machine or object and the results seen immediately

Benefits from use of AR

With AR the cost of a building a physical user interface is avoided and shortcomings of a physical user interface are eliminated or reduced.

Digital assets

Graphics that show live data, graphics that simulate a control panel component

Environment

Any environment in which there are network-connected machines or objects and an interface is absent or not clear, indoors or outdoors, any noise level, any level of complexity

Stakeholders

Any environment in which there are network-connected machines or objects and an interface is absent or not clear, indoors or outdoors, any noise level, any level of complexity ***External Links or Examples***

Augumenta's Smart Panel	http://augumenta.com/smartpanel/
write up about the concept (June 2016)	https://sdtimes.com/ar/augumenta-introduces-new-augmented-reality-interface/
Daqri's CIM integration for Power use cases	https://youtu.be/fkslM37EcXA
write up when it was shown (2015)	http://thearea.org/ar-news/epri-shows-use-of-common-information-model-and-and-augmented-reality-with-daqri-smart-helmet/
iQagent + SCATA on HoloLens	https://iqagent.com/hololens/
video testimonial	https://www.youtube.com/watch?v=XK_hW_c99Xs