Smart and Adaptive Interfaces in INCLUSIVE Project: MyAid - an improved troubleshooting workflow

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MyAid - an improved troubleshooting workflow

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Summary

- Troubleshooting: From an unknown machine fail, to the machine recover

- Tools: Alarm list + Manuals, personal skills, hot line

- Operator cognitive capabilities

- Manual structure guide the operator to identify and fix the problem
  - Atomic steps: Specific questions (not: “is the sensor working?”)
  - is based on a binary tree: (a) Questions (b) Procedures

- Information ubiquity: have it where you need

- Yes, machine talks!
Summary

- Troubleshooting: From an unknown machine fail, to the machine recover

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  - is based on a binary tree: (a) Questions (b) Procedure

- Information ubiquity: have it where you need
  - HMI: step by step, structure not based on sequential search, but on a tree mobile: information where you need it, possibility of remote assistance with a/v
  - AR: hands free and lightweight interface

- Communication with machine
  - Particular condition of the machine (e.g. alarms) can trigger the visualization of particular pages
  - Operator can search for solution about product anomalies (problems in assembling or in the result of some process)
  - Operations of predictive maintenance can be triggered according to time or #products or production time
Troubleshooting

- Process of recovering the machine from an unknown machine fail to the production state
### HMI Alarm Panel

**Operator:** Mario

<table>
<thead>
<tr>
<th>ID</th>
<th>Alarm Name</th>
<th>Timestamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>73</td>
<td>Air conditioner malfunction</td>
<td>12:24:35 18/06/2014</td>
</tr>
<tr>
<td>64</td>
<td>Left gate open</td>
<td>12:26:45 18/06/2014</td>
</tr>
<tr>
<td>353</td>
<td>No material over infeed conveyor</td>
<td>12:26:46 18/06/2014</td>
</tr>
<tr>
<td>350</td>
<td>Ethernet communication 1 timeout</td>
<td>12:26:48 18/06/2014</td>
</tr>
<tr>
<td>355</td>
<td>Module B downstream not ready</td>
<td>12:26:48 18/06/2014</td>
</tr>
<tr>
<td>1</td>
<td>Machine power off</td>
<td>12:26:50 18/06/2014</td>
</tr>
<tr>
<td>5</td>
<td>Low air pressure</td>
<td>12:26:50 18/06/2014</td>
</tr>
<tr>
<td>69</td>
<td>Alarm panel</td>
<td>12:26:50 18/06/2014</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

**Production rate:** 2500 Prod/hr

**Producing:** Prod ID #4

**Production type:** Bottle #3as4

**Panel ver:** v.1.402
Tools 2/4: Manuals
Tools 3/4: Personal skills & Experience

Popular Skills for Production Operator

- Quality Assurance / Quality Control
- Troubleshooting
- Assembler
- Equipment Maintenance
- Machine Operation

Experience Affects Production Operator Salaries

<table>
<thead>
<tr>
<th>Experience Level</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late-Career</td>
<td>▲ 17%</td>
</tr>
<tr>
<td>Experienced</td>
<td>▲ 13%</td>
</tr>
<tr>
<td>Mid-Career</td>
<td>▲ 6%</td>
</tr>
<tr>
<td>National Average</td>
<td>$36,000</td>
</tr>
<tr>
<td>Entry-Level</td>
<td>▼ 9%</td>
</tr>
</tbody>
</table>

This chart shows the most popular skills for this job and what effect each skill has on pay.
Tools 4/4: Assistance
Production operator profile

Job Description for Production Operator

Production operators monitor equipment during operations. Attention to detail while monitoring gauges and lines is required. The ability to troubleshoot and maintain production line machinery typically is preferred. Operators generally are responsible for accurately and completely documenting production activities in a timely manner. Auxiliary tasks may include housekeeping, inspections, safety walkthroughs, organization, and transport. Responsibilities may include direct handling of products including during production, specification checks, and packaging.

Production operators generally work for a materials manufacturing or production company, with their work located directly on the manufacturing floor. Shifts may occur at any point in the day (day, evening, overnight), including overtime and holiday hours. Production operators must be able to work in a dynamic, noisy environment, and they must be comfortable with frequent physical activity for extended periods of time. Comfort with operating production machinery is a must; Fork truck experience typically is a bonus.

High school diploma or a GED equivalent normally is required in this position. For specialized positions and operations, further training or certifications might be required. General math and writing skills are required. The ability to multitask and handle tasks alone is a must; however, team work and cooperation is also important. Given that product needs to meet company and legal specifications, the ability to meet deadlines and execute tasks accurately and timely is extremely important. (Copyright 2017 PayScale.com)

Production Operator Tasks

- Simultaneously operate multiple pieces of equipment to produce products efficiently.
- Monitor gauges or other indicators to assess progress, production, and maintenance needs.
- Inspect and quality check products, and verify accuracy.
- Interpret specifications and calibrate machines to reach goals.

Gender

- Female: 22%
- Male: 78%
One or more workers are needed to stand by the production line to monitor production.
Floor plant horror story

- When consumables end, they are in charge to replace them.
In case of product change, the operators have to adapt the parameters of the receipts.
Floor plant horror story

- Operators check for faults and alarms, performing the necessary maintenance and troubleshooting
Floor plant horror story

- The solution to these issues should be done as fast as possible.
Simpler structure for documentation

- Documentation sometimes induces confusion
Technical info are stored in a DITA doc (Darwin Information Typing Architecture - an extended XML information container).

Information are processed to create automatically user interfaces.

Alarm filter in machine controller activate the entry point of the procedure.
Online troubleshooting

- Documentation is decomposed in atomic steps

Remove and clean the sleeve drum and lower ring

- This procedure lists the steps needed to remove and clean the sleeve drum and the lower ring.

- Remove the safety ratchet (1).
- Turn the vacuum chamber platform (3) clockwise using the supplied key (2) and take it out of its housing.
- Remove the chamber platform from the sleeve drum.

- Unscrew the central screw (4) in the sleeve drum (with the help of an Allen spanner).
Online troubleshooting

- Documentation is decomposed in atomic steps
- Decisions tree is based on specific questions about symptoms (not: “is the sensor working?”)

Is not the sensor cable connected properly at both ends?

- This procedure lists the steps needed to check sensor's connections.
- Check connectors oxidation: test cable using a tester or test swap with a functional cable.
- Check sensor defective: test swap a function sensor to the same cable.
- If the sensor's cable is not connected properly, press YES button.
Online troubleshooting

- Atomic steps
  - Specific questions (not: “is the sensor working?”)

- is based on a binary tree
  - Questions
  - Procedure
Information ubiquity

- Have the documentation where you need it
- HMI: robust, already available, cheap
Information ubiquity

- Have the documentation where you need it
- Tablets, cellphones: mobiles, detachables.

Allows hand free operations
Information ubiquity

- Have the documentation where you need it
- Tablets, cellphones: mobiles, detachables.
  - They can increase the interaction
e.g. camera: Augmented reality, A/V assistance calls
Information ubiquity

- Have the documentation where you need it
- Wearable: hands free and lightweight interface possibility to overlay interface with real machine
Offline training

- Train operator with the documentation
- Predefined scenes, they can explore to answer the questions proposed
Communication with machine

- Particular conditions of the machine (e.g. alarms) can trigger the visualization of particular pages.
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Communication with machine

- Operator can search for solutions about product anomalies (problems in assembling or in the result of some process)

Welcome to the Troubleshooting Guide

- Alarm: Alarm 36
- Alarm: Alarm 101
- Product anomaly: Label alignment is not correct
Communication with machine

- Operations of predictive maintenance can be triggered according to time or products or production time.

Clean the photocell

- Turn off the sensor
- Unplug the sensor
- Unscrew the screws
- Clean the sensor
- Apply the four screws
- Attach the cable
- Turn on the sensor
Recap

- **Troubleshooting**
  - From an unknown machine fail, to the machine recover

- **Tools**
  - Alarm list + Manuals
  - Personal skills, Experience
  - Panic button: Assistance

- **Manual structure guide the operator to identify and fix the problem**
  - Atomic steps
    - Specific questions (not: “is the sensor working?”)
  - is based on a binary tree
    - Questions
    - Procedure

- **Information ubiquity: have it where you need**
  - HMI
  - Tablet, mobile
  - Wearable devices

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