Harmonizing Human-Machine Interfaces: A Standard Reference Guide for HMI Design and Management at NCNR

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*Mentorship and Guidance From: Whipple, James R. (Fed) & Newby, Robert D. (Fed)*
Outline

• Background: What is an HMI?
• HMI’s at NIST, who created them.
• The problem?
• Our solution, and its projected implementation.
• Future work
Design References

8. REFERENCES


What is an HMI?
The current HMI’s at NIST, and who created them?

Noise Monitor HMI created by James Whipple
The problem?
Task Analysis

Task analysis is the process of understanding how a user performs their task and achieves their goals.

*NUREG-0711 defines a task as a “group of related activities with a common objective.”*
User Definition

- Understanding End-Users
- Significance of User Experience
- Four Key User Groups
  - Guided by ANSI/ISA 101.01 standard definitions
- Unique Needs of Each Group
- Designer’s Role
Uptime

In the face of increasingly complex machinery, it is crucial to understand that the sophistication of Human-Machine Interfaces (HMIs) does not render them immune to system failures and lockouts.
Level Hierarchy in HMI’s

References:
Rockwell Automation Process HMI Style Guide
Navigation

When considering the design of an HMI, navigation plays a pivotal role. Image provided by ASM Consortium.
## Color Hierarchy

<table>
<thead>
<tr>
<th>Color</th>
<th>UI Element</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>P&amp;ID Device Icons such as pumps and motors</td>
<td>Running</td>
</tr>
<tr>
<td></td>
<td>Alarms</td>
<td>Alarm is active.</td>
</tr>
<tr>
<td>Green</td>
<td>P&amp;ID Device Icons such as pumps and motors</td>
<td>Stopped</td>
</tr>
</tbody>
</table>
Situational Awareness

No Change
Perception
Gather Information
Change
Observation
Communication

Situational Awareness Levels

- Comatose – Not able to function
- High Alert – Confirmed threat, must act
- Focused Awareness – Carefully observing a potential threat
- Relaxed Awareness – Enjoying life while paying attention
- Tuned Out – Not paying attention
Conclusions and Future Work

1. Definitions

GUI: Graphical User Interface
HF: Human Factors
HMI: Human-Machine Interface
HP: Human Performance
HRA: Human Reliability Analysis
HSE: Human Safety
PLC: Programmable Logic Controllers
PS: Performance-Shaping Factor
SA: Systematic Analysis

Any individual who operates or controls an HMU as part of their duties assigned in the NCS.

2. Introduction

2.1. What is an HMU?

An HMU, or Human-Machine Interface, is more than just a user interface; it’s a crucial platform designed specifically to enable users to observe, control, and troubleshoot mechanical systems and apparatus. Although it is feasible to apply this definition to any interactive screen engaging with a device, the usage of HMU is predominantly used within industrial contexts.

HMUs and Graphical User Interfaces (GUIs) have some similarities in functionality; however, they are not interchangeable concepts. Often, GUIs are utilized within HMUs to augment the visual interpretation of information.
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