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)

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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

[1] Opto22, "*Building an HMI that Works: New Best Practices for Operator Interface Design*," Available: https://documents.opto22.com/2061_High_Performance_HMI_white_paper.pdf

[2] Whipple, James R. (Fed) & Sahin, Dagistan (Fed). Interview. Conducted by Navid Misaghian. 15 June 2023.

[3] ISA-TR101.02-2019 - HMI Usability and Performance

[4] ANSI/ISA-101.01-2015 - Human Machine Interfaces for Process Automation Systems

[5] ANSI/HFES 100-2007 - Human Factors Engineering of Computer Workstations

[6] NASA Ames Research Center, Color Usage Research Lab - https://colorusage.arc.nasa.gov/

Rockwell Automation Process HMI Style Guide White Paper

[7] Mica R. Endsley, "Designing for Situation Awareness in Complex Systems," Proceedings of the second international workshop on symbiosis of humans, artifact, and environment, Kyoto, Japan, 2001. http://satechnologies.com/Papers/pdf/SA%20design.pdf

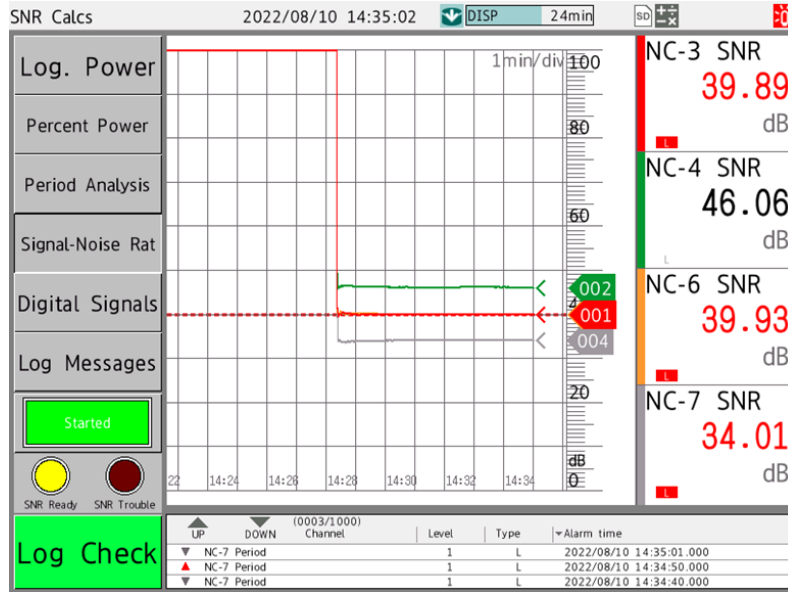[8] PROCES-RM002 (Rockwell Automation Library of Process Objects: Configuration and Usage)

[9] PROCES-RM014 (Rockwell Automation Library of Process Objects: Display Elements)

[10] Usability Body of Knowledge, UXPA, http://www.usabilitybok.org/task-analysis

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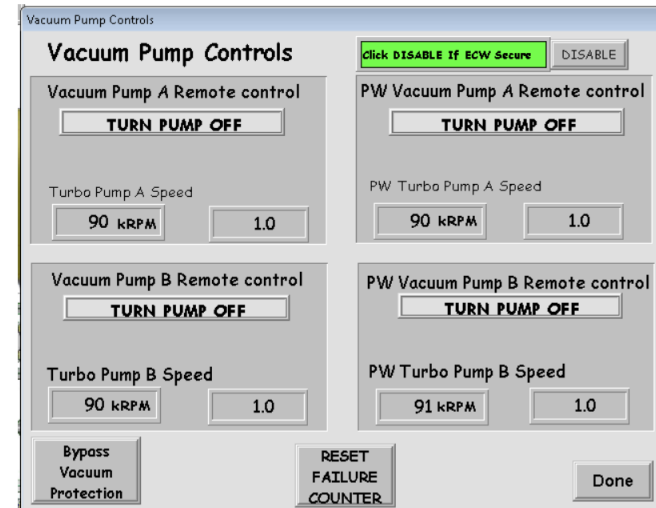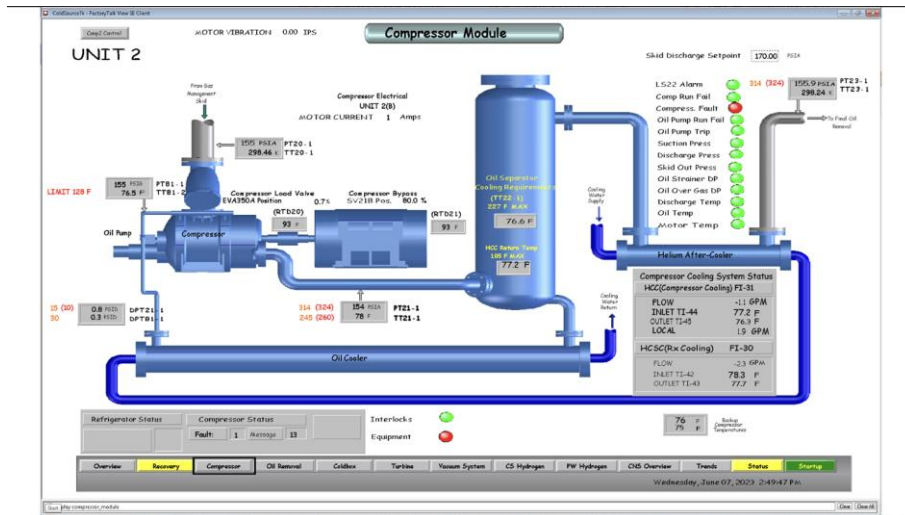
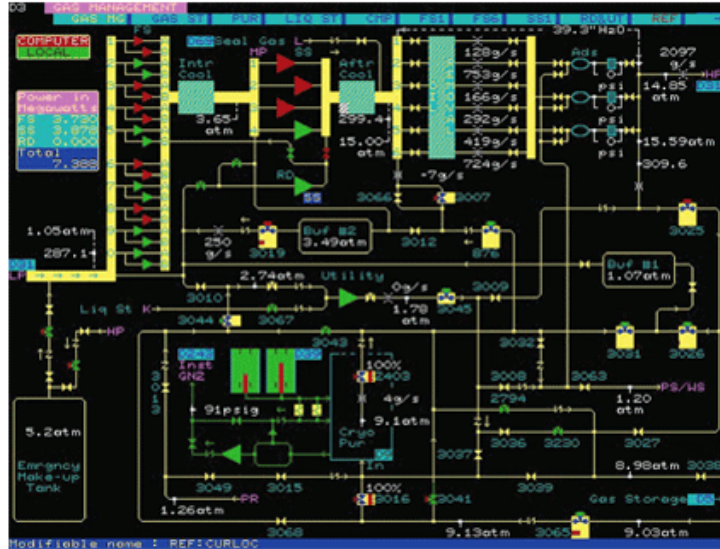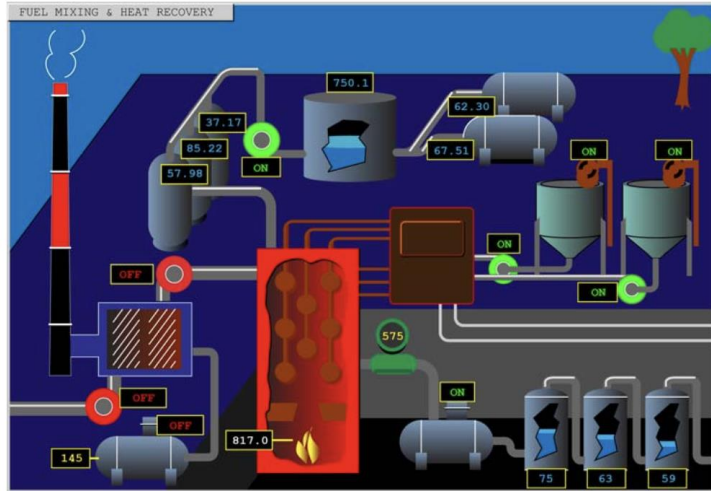# The current HMI's at NIST, and who created them?

Noise Monitor HMI created by James Whipple

The problem?

An example of a poor HMI

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.

Digital Clocks w/Seconds

+ HMI

Level Hierarchy in HMI's
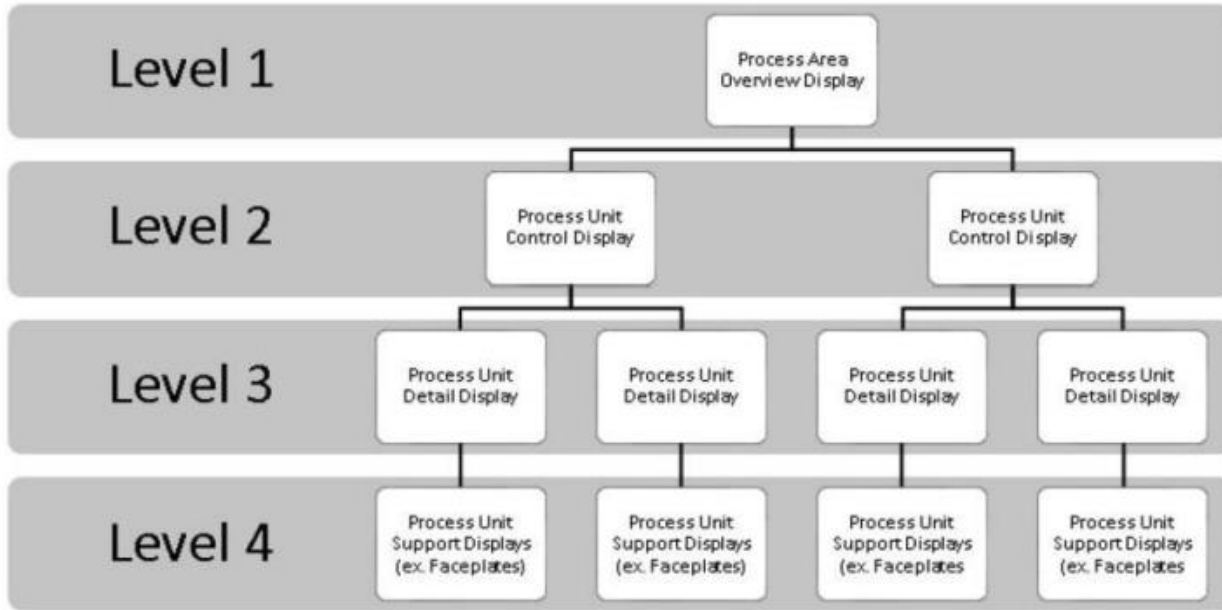
References:
Rockwell
Automation Process
HMI Style Guide

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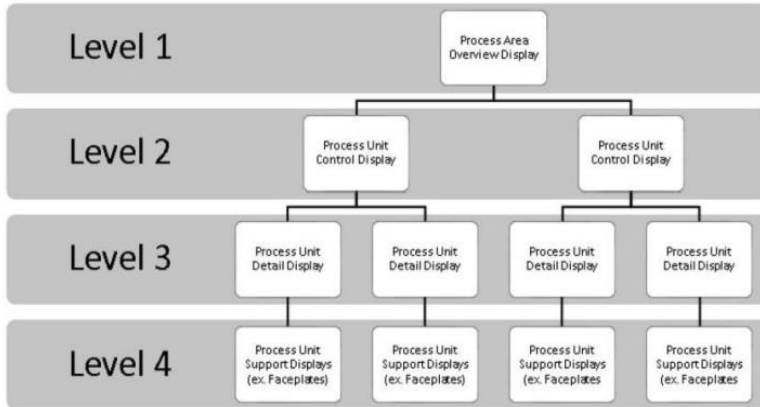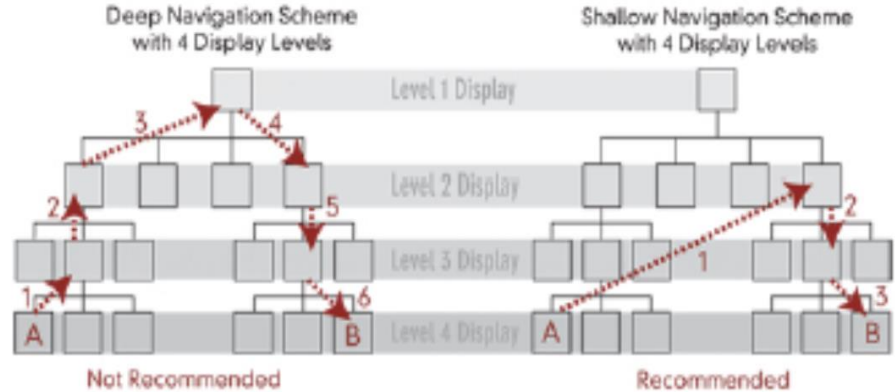
When considering the design of an HMI, navigation plays a pivotal role. Image provided by ASM Consortium.

Color Hierarchy

Color	UI Element	Meaning
Red	P&ID Device Icons such as pumps and motors	Running
	Alarms	Alarm is active.
Green	P&ID Device Icons such as pumps and motors	Stopped
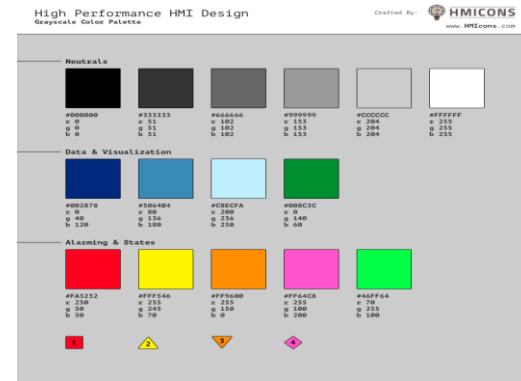
Situational Awareness
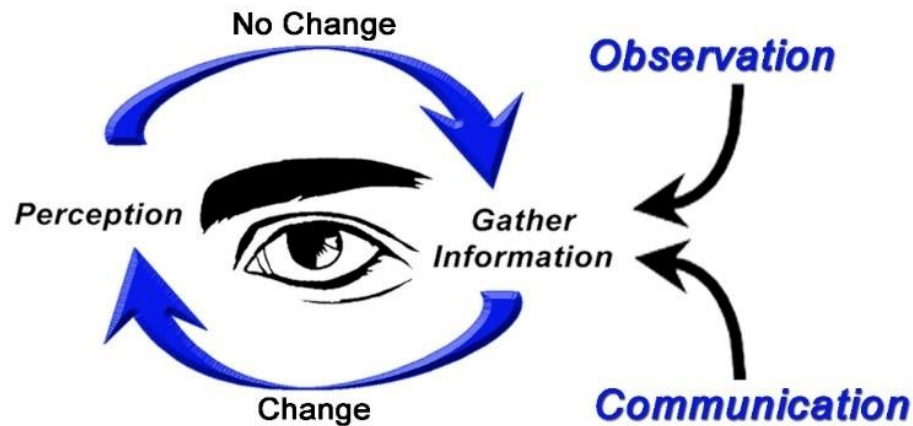
Conclusions and Future Work

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