ISA101, Human Machine Interfaces

Applying ISA101 Concepts to Existing HMI Applications
Michael E. Hawrylo

• First introduced to HMI’s during a college internship
• Earned his Bachelor of Chemical Engineering degree in 1998 from the University of Delaware
• Started career as a traditional process engineer
• Joined Applied Control Engineering, Inc. (ACE) in 2000
• Based in ACE’s Newark, DE headquarters as a Team Leader and a lead technical resource
Standard Overview

What is published?

- ANSI/ISA-101.01-2015, Human Machine Interfaces for Process Automation Systems
- Technical Report Workgroups are just starting as of October 2015. The workgroups are:
  - HMI Philosophy, Style Guide & Design Guide
  - HMI Usability and Performance
  - HMI for Mobile Platforms
Presentation Overview

Intended targets

• System implementers
• System end users
• Both groups work together throughout the HMI lifecycle
  – Design
  – Implementation
  – Operation
  – Continuous improvement
Purpose of today’s talk

• Discuss how to use the ISA standard and HMI concepts with your existing systems
• This presentation is *not* intended to define
  – How your HMI should be designed, what colors to use, what furniture to use in your control room, etc.
  – How to administer your HMI change control process, including management of change and training
  – How to implement HMI changes and best practices
Our Challenge

Existing HMI systems may

- Not be designed to a common style guide
- Not use common graphic toolkits
- Be configured by multiple system implementers
- Be designed with a P&ID set as the lone design criteria
Our Challenge

Desired HMI guidelines

• You know and/or want your HMI to use
  – Consistent colors
  – Process objects from a common toolkit
  – Embedded trends and contextual information
  – Etc.

• Your desired updated graphics may not be simple representations of P&IDs
Our Challenge

How to improve existing HMI systems

• Discover opportunities for the continuous improvement of HMI systems
  – Interview operations, maintenance, and other users
  – Review process and safety incidents

• Present opportunities and solutions to
  – System owners and end users
  – Plant management
Our Challenge

Existing HMIs are not carved in stone

- ISA101 discusses an HMI life cycle
- System owners and end users should be familiar with similar life cycles
  - Safety system life cycle (ISA84)
  - Alarm management life cycle (ISA18.2)
HMI Life Cycle

CONTINUOUS WORK PROCESSES

- MOC
- Audit
- Validation

SYSTEM STANDARDS

- Philosophy
- Style Guide
- Toolkits

DESIGN

- Console Design
- HMI System Design
- User, Task, Functional Requirements
- Display Design

IMPLEMENT

- Build Displays
- Build Console
- Test
- Train
- Commission
- Verification

OPERATE

- In Service
- Maintain
- Decommission

New System Major Changes

New Display Display Changes

ENTRY

Continuous Improvement

from Section 4 of ANSI/ISA-101.01-2015
HMI Life Cycle

Starting an HMI upgrade

• Begin process by defining your
  – Philosophy
  – Style guide
  – Toolkits

• Focus on how a “new” HMI would operate

• Engage system users and owners
Continuous improvement

• Two sources for improvement concepts
  – System designers and implementers
  – System end users

• End users may be more focused on the style guide

• Implementers may be more focused on the toolkits
Style Guide

Implementation into existing HMI systems

• Improvements can be incremental
• Focus on small changes that increase HMI effectiveness
  – Color usage
  – Navigation
  – Object animation
Use of color

• Gray backgrounds are used to minimize glare and provide a low-contrast depiction
• Bright colors should only be used to highlight alarms and abnormal situations
• Colors that are used for alarms should not be used elsewhere
Use of Color, Example
Use of Color, Example
Navigation

• Techniques are employed to facilitate quick and efficient navigation
• Consistent navigation techniques are used throughout the system
Navigation, Example
Navigation, example
Existing HMI Upgrades

Object animation

- Highlight only abnormal situations
  - E.g. change color when in alarm
- Gratuitous animation should be avoided
  - Refrain from having
    - Spinning motors
    - Moving conveyors
    - Splashing liquids
    - Fire breathing burners
Object Animation, example
Object Animation, Example
Existing HMI Upgrades

Low hanging fruit

• Provide HMI improvement with minimal “under the hood changes”

• Provide a basis for further improvements with the use of
  – Process object toolkits
  – Embedded trends
  – Human factors engineering
Toolkits for common equipment types

- Designed to meet philosophy and style guide standards
- Configured for specific technologies
- Implemented for
  - Dynamic objects
  - Faceplates
  - Static objects
Valve animation

- Column 1: no feedback; with actuator output
- Column 2: opened and closed indication
- Column 3: transitional states
- Column 4: alarm states
Contextual Information

Operators need information

• Current values do not tell a story

• Analog bars can show
  – Process contextual information (e.g. at SP)

• Trends can show where a value
  – Has been
  – Is likely going
Is This Process Happy?

adapted from example in
The High Performance HMI Handbook, First Edition
by Bill Hollifield, Dana Oliver, Ian Nimmo, & Eddie Habibi
Situation Awareness

What does situation awareness mean?

• Being aware of what is happening in the process
• Understanding the process state now
• Understanding the likely process state in the future
Imbedded Trend Example

What is the direction of the tank level?
Where Do We Begin?

Upgrading existing HMIs

• Know your system
  – Interview users and owners
    – Do they like this system?
    – Where does the system need improvement?

• Produce results
  – Start small
  – Show value
What To Do After We Start

from Section 4 of ANSI/ISA-101.01-2015
Upgrading Notes

• Test and review
  – What works well at your site?
• Style guide and philosophy
  – What needs to be created?
  – What needs to be added?
• Toolkits
  – What objects need to be created?
  – What technologies need to be address?
References

• ANSI/ISA-101.01-2015, Human Machine Interfaces for Process Automation Systems
ISA101, Human Machine Interfaces

Applying ISA101 Concepts to Existing HMI Applications