

IPRO 303

Information Design for Plant Management to Predict Equipment Failure

MIDTERM REPORT

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Sponsors: SmartSignal
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Date: Friday, March 14, 2008

1. Objectives

IPRO 303 is working on the user interface for SmartSignal Corporation's software which predicts equipment failures in coal fired power plants. We are now in the third stage of the project. We are to deliver the user interface of the software based on the studies done by two previous semesters. SmartSignal suggested that we also consider specific elements of the software such as the clear presentation of developing fault information, and the efficient communication system between users. An appropriate UI will utilize SmartSignal's predictive analysis software to provide an efficient and clear means for power plant personnel to:

- Predict or identify equipment faults
- Understand the predicted faults
- Prioritize the disposition of the predicted faults or highlight urgent or important faults
- Reduce the need for plant personnel to have many years of experience or "institutional knowledge"

The ultimate goal of this project is to introduce an innovative approach to the user interface which SmartSignal can use for predicting equipment failures in coal fire power plants. To realize this, we set these objectives.

- Research and collect information relative to the User Interfaces [UI] from the first hand users of the software (*This objective was changed. Previously it ended including the phrase "while examining the study done by a previous IPRP303". This change was made after the team concluded the prior study did not prove useful*)
- Create the Requirements Document for the UI in light of the concerns expressed by SmartSignal and the results of research.
- Generate several possible UIs based upon the Requirements Document stated above.
- Select one of the Several UI for development of details and revise it based upon the input from SmartSignal.
- Add details and finalize the design of the selected UI.

2. Results to Date

The team created three sub-teams to achieve the overall objectives of the project. The three sub-teams are: Team 1, the High Level Design Team, Team 2, the Communication Team, and Team 3, The Fault Analysis Team.

Team 1, The High Level Design Team, has conducted research using available resources to gather information on UI structures. The team has developed three initial conceptual approaches for the design of a UI. They are:

- The “Directionally Linked UI”. This UI has also been described as a “Top Down” approach. The primary focus of this UI is to keep the computer screen simple by presenting a limited amount of information at any time while allowing the user to access more detailed information as needed.
- The “Search and Solve UI”. This UI enables the user to begin with a graphic or view of the power plant and point and click to examine any specific system, machine or part to investigate a specific incident.
- The “Full Disclosure UI” is similar to the “ Search and Solve UI” but adds the feature of being able to designate error priority levels based upon a color coding system.

Team 2, The Communication Team, has generated a list of potential questions relating to the flow of information in a power plant. The communication Team scheduled a visit to Midwest Generation’s Waukegan power plant. Four team members visited the plant on 3-13 and gathered information for the further development of UIs. The team Hopes to schedule a second trip to another plant in the near future.

Team 3, the Fault Analysis Team, has generated a list of questions to ask power plant personnel to gain an understanding of what information is needed to enable them to effectively analyze faults. A Team 3 representative visited the power plant with Team 1 and 2 members.

The IPRO303 Team met with SmartSignal on 3/12/08 and presented its three UIs. SmartSignal expressed their appreciation of the team’s concepts and provided further direction. The team will consider SignalSignals feedback as it moves into the next stage of the IPRO; the further development of one UI.

3. Revised Schedule of Tasks and Milestones

The only change to the chart is:

1. The SmartSignal visit was pulled in from the week of 3/17 to the week of 3/10. The reason for this change was to work around the week of spring break at IIT.

IPRO 303																
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WEEK & DATE 2008	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TASK	1/21	1/28	2/4	2/11	2/18	2/25	3/3	3/10	3/17	3/24	3/31	4/7	4/14	4/21	4/28	5/5
6.0 Team Schedule of Tasks and Milestones																
Team Organization																
Define Objectives																
Define Approach																
Define Sub-teams																
Assign sub-team members																
Team 1- High level Design Team																
Brainstorming structure of the UI																
Apply brainstorming and research to UI										DD						
Generate 3 Distinct High level UI											MS					
Get feedback from teams 2 and 3																
Give initial asthetics to SS									DD							
Get feedback from SS																
Consider Feedback																
Generate Final UI														MS		
Team 2- Communications Team																
Accumulate questions to ask users																
Schedule plant visit(s)																
Visit Plants-interviews								MS								
Analyze intelligence																
Transfer intelligence to teams 1 +3																
Prepare Presentation															DD	
Team 3- Fault Analysis Team																
Brainstorm Bottom up abstractions																
Apply Abstraction to UI																
Smart Signal Visit								DD								
Develop one UI															DD	
Generate UI Specification, Requirement List															DD	
Smart Signal Presentation															MS	
Project Team- Generate Reqmts. doc.														MS		
6.0 General Schedule of Significant Activities and Events																
Presentation Skills & Day Tips Workshop:																
Web Site															DD	
Exhibit/Poster															DD	
Abstract/Brochure															DD	
Presentation															DD	
Final Report with table of contents															DD	
IPRO Deliverables CD PLUS															DD	
Projects Day Conference:															DD	
IPRO Games																
Ethics Workshop:																
Mid-Term Progress Report								DD								
Team Work Product: Team Minutes																DD
Learning Objectives Test Session:																
Mid-Term Review																
Mid-Term Peer Evaluation Opportunity																
IIT On-Line Course Evaluation																
Team Debriefing Session:																
Smart Signal Presentation																DD
TASK	1/21	1/28	2/4	2/11	2/18	2/25	3/3	3/10	3/17	3/24	3/31	4/7	4/14	4/21	4/28	5/5
WEEK & DATE 2008	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Milestone			Due Date			Effort before Due Date			Just do it					
		MS			DD											

4. Changes in Individual Team Member Assignments

A. **Team Leader:** Simons, Ray

B. Sub-teams

- Team 1: High - Level Design Team
 leader: McAnally, Arthur - Directional Link UI (UI name added)
 members: Kim, Jihyung- Full Disclosure UI (UI name added)
 Fujimoto, Haruko – Search and Solve UI (UI name added)

The high level design team creates multiple User Interfaces and simulates the designed UIs. The team incorporates specifications SmartSignal requires and the results of the other two team's research. The team analyzes visual effects of User Interfaces and efficient ways to present information on the screen.

- Team 2: Communication Team
 leader: Fleming, Rachel
 members: Simons, Ray
 Lee, Sangwook

The communication team researches information flow within the power plant. The team visits power plants and conducts interview with plant workers. It finds links and hierarchies within the plant departments. The team makes flow chart of information that conveys relevant information from lower level workers/departments to higher level. The team provides design concepts to the high level design team based on its interviews and research.

- Team 3: Fault Analysis Team
 leader: Dodds, Jacob
 members: Erogbogbo, Samad
 Hazariwala, Nirav

The fault analysis team decides which piece of data/information to be in the report sent to workers/shift supervisors/engineering specialists. It determines who needs what kinds of information under certain circumstances or accidents. The team defines the state of warning, alert, incident, and fault. The team develops mechanisms that effectively deliver the reports to the appropriate people. The team develops the selected UI that represents all the requirements.

5. Obstacles

An initial obstacle was the lack of clear direction from SmartSignal. The team wanted SmartSignal to provide definition or attributes of a desirable UI. SmartSignal wanted the team to take a more open ended approach and develop concepts without being constrained by preconceptions. This obstacle was overcome when the team accepted this lack of definition and launched into brainstorming concepts.

The initial lack of team organization was an obstacle. Because the team had difficulty defining a direction in which to work, it had difficulty knowing how to organize as a team. Once the team decided to develop three design approaches it became obvious that our organization should be around our three teams.

We expected the information from the previous IPROs to be more useful than it has proven to be. We viewed this as an obstacle. It necessitates our teams gathering information from power plant personnel which could have been gathered during the previous IPROs. We will overcome this obstacle by doing the research, gathering the information during our plant visit(s) and through other means.

Scheduling power plant visits has been slow and difficult. Reaching appropriate personnel and scheduling one or more power plant visits have been obstacles. As mentioned above, We visited one plant on 3/12/08 and will continue to make efforts to visit at least another plant. The information gathered during our plant visit(s) and the feedback from SmartSignal visit will enable the team to move forward and successfully complete this project.