IPRO 303

Information Design for Plant Management to Predict Equipment Failure

PROJECT PLAN

Instructor: Edmund C. Feldy PE
Sponsors: SmartSignal
IPRO Team: Jacob Dodds, Samad Erogbogbo, Rachel Fleming, Haruko Fujimoto, Nirav Hazariwala, Jihyung Kim, Sangwook Lee, Arthur McAnally, Ray Simons
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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 while examining the study done by the previous IPRO303.
- 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. Background

A. Sponsor Information: SmartSignal is a corporation that provides applications to increase equipment performance by means of predictive analysis. SmartSignal's solution analyzes information gathered from every piece of equipment of power plants, monitors behavior of the plant as a whole, and identifies the level of contingencies. SmartSignal's clients include a number of major power plants nationwide and worldwide. The company is located in Lisle, Illinois.

B. Current User Problems: SmartSignal's solution needs improvement in User Interface so that it can present and deliver relevant information and early warning reports directly to the plant workers involved in the problems predicted or occurred. In addition, the current system causes information overload because the monitoring screen displays an unmanageable number of warnings at the one time.

C. Technology Involved: A good deal of programming knowledge and designing skills are necessary in order to create User Interfaces which efficiently display information.

D. Other Attempts to Solve the Problem: SmartSignal personnel are also working on alternative User Interface solutions.

E. Ethical Issues: SmartSignal operates in a competitive market and any classified or sensitive information or documents obtained from the SmartSignal company will be kept confidential and will not be disclosed to anyone outside the project team.

F. Business Cost: There is a trend of young inexperienced employees gradually replacing older knowledgeable staff; the loss associated with this is irretrievable. The UI aims to bridge this gap.

G. Implementation of the Solution: Recommend SmartSignal create several beta test sites to simulate the proposed UIs. Following the successful simulations. The gradual, time-phased, product launch is recommended.

H. Similar Solutions Proposed: SmartSignal indicates that their approach to predicting power plants equipment failure is unique. Other competitors companies build generic models of a piece of equipment and treat the same pieces in the same way. SmartSignal not only sees each piece of equipment as a totally different device, but also takes into account surrounding conditions of the plants and inputs/feedbacks from the workers.

3. Methodology/ Brainstorming/Work Breakdown Structure

A. Defining the problems

Create a User Interface (UI) that utilizes already existing knowledge of coal-fired power plant equipment failure prediction and makes the information manageable as well incorporates as the following:

- Easily accessible and understandable information
- Integrates all the decision-makers at the power plant
- Clear presentation of information or analysis results

B. Defining how the team will go about solving those problems

1. Understanding the task

The Team met with our sponsors, SmartSignal, to further understand the task at hand. Our sponsor's representatives gave a presentation to the team. In their presentation they described how the software works through the modeling, analysis and recommendations for possible failure of a power plant component or equipment. Our sponsor's suggested that the problem might be better solved without any bias from actually seeing the software's current UI or a sample prediction. After the meeting and

without the benefit of seeing the software an approach was gradually fashioned. The following are the tasks that were outlined by the team as a viable approach:

- Get a better understanding of how a power plant works as a system.
- Interview plant members to understand the chain of decision-making that is or is not present in a power plant.
- An example of such a decision making chain could be a plant staff that is responsible for a specific plant component sees an alert and is responsible for alerting someone else. The flow and storage of this information should be easy and accessible for historical worth.
- Perform further research using available resources to gather more information on standard UI structures.
- Analysis of information received
- Based on the results from the power plant staff interviews, further research and analysis, multiple approaches as to how the UI would look will be determined.
- Design multiple User Interfaces that applied all the information gathered from previous steps as well integrating the little knowledge of the pre-exiting UI.
- Present multiple UI's to our sponsor, SmartSignal, for progression analysis.
- Revise or Rebuild or Re-design the User Interface based on the comments or suggestions from presentation to sponsor.
- Presentation of new or revised User Interface to sponsor.
- Possible final UI

2. Initial Organization

After defining the above tasks sub-teams were determined and assigned. Sub-team members were assigned based on their technical skills, Major of study, familiarity with determined tasks. There were three (3) sub-teams formed: High-level design team, Communication team, and Fault analysis team. Each of the sub-teams has a leader to ensure that everything progresses in a timely manner. The team assigned officer responsibilities such as appointing Project Leader, Minute taker, and Master scheduler. Multiple Sub-Teams were assigned to tend to the various IPRO deliverables according to the stated criteria or in some cases as volunteers.

C. Analysis

The outcomes of the steps taken in the understanding the task sections as defined above will be regarded as analysis in and of itself.

D. Documentation

Each Sub-team will maintain a record of their respective goals and specific questions that they ask as they progress with their assigned tasks.

E. Analysis of the expected results

Our sponsor to some level will determine the actual testing and conclusions; After the initial UIs have been developed SmartSignal, our sponsor, will be meeting with our team to reinforce or correct our direction. A follow up visit to a power plant with a well-designed questionnaire could be used as a measure of our expected results.

F. Production of IPRO Deliverables

Other than required IPRO deliverables there will be other documents which are the following:

a. Multiple designs of proposed User Interfaces, which may include a graphical representation, a working demo or a written description.

b. A requirements document generated for the UI that address our sponsor's concerns as well as other requirements that the team's research uncovers.

c. A document comparing the new design to the old UI designs if we have access to it.

d. A document detailing our IPRO design process for next semester's IPRO if need be or for future reference.

G. There are no documents that need to be attached to this project plan.

4. Expected Results

A. The results of this IPRO include generating an efficient and dynamic software structure, designing the appropriate fault analysis system, and developing a high level UI.

B. The research and information gathered on power plants will give a clear understanding of the end-users' needs. It will be the source of the UI design ideas the team generates.

C. The requirements document for the UI will be produced from the research and the input by the users. Based on this document, at least three different UI (high level view/ approach) prototypes will be generated.

D. By introducing these UI prototypes to SmartSignal, we will receive further input for a final design. One of the three UIs will be selected and implemented to a detailed level. The final design of the UI will reflect A through C above.

E. Artwork and a visual presentation will be produced to illustrate the UI.

F. The final UI will reflect the needs of first hand users as well as the SmartSignal concerns. The final product will be potentially the prototype of the user interface which can be modified and fit to other software use.

5. Budget

IPRO Day	$300 - Presentation board, handouts, visual supplies
Misc.	$150 - Basic supplies, printing
Transportation	$150 - Visiting Power plants and SmartSignal
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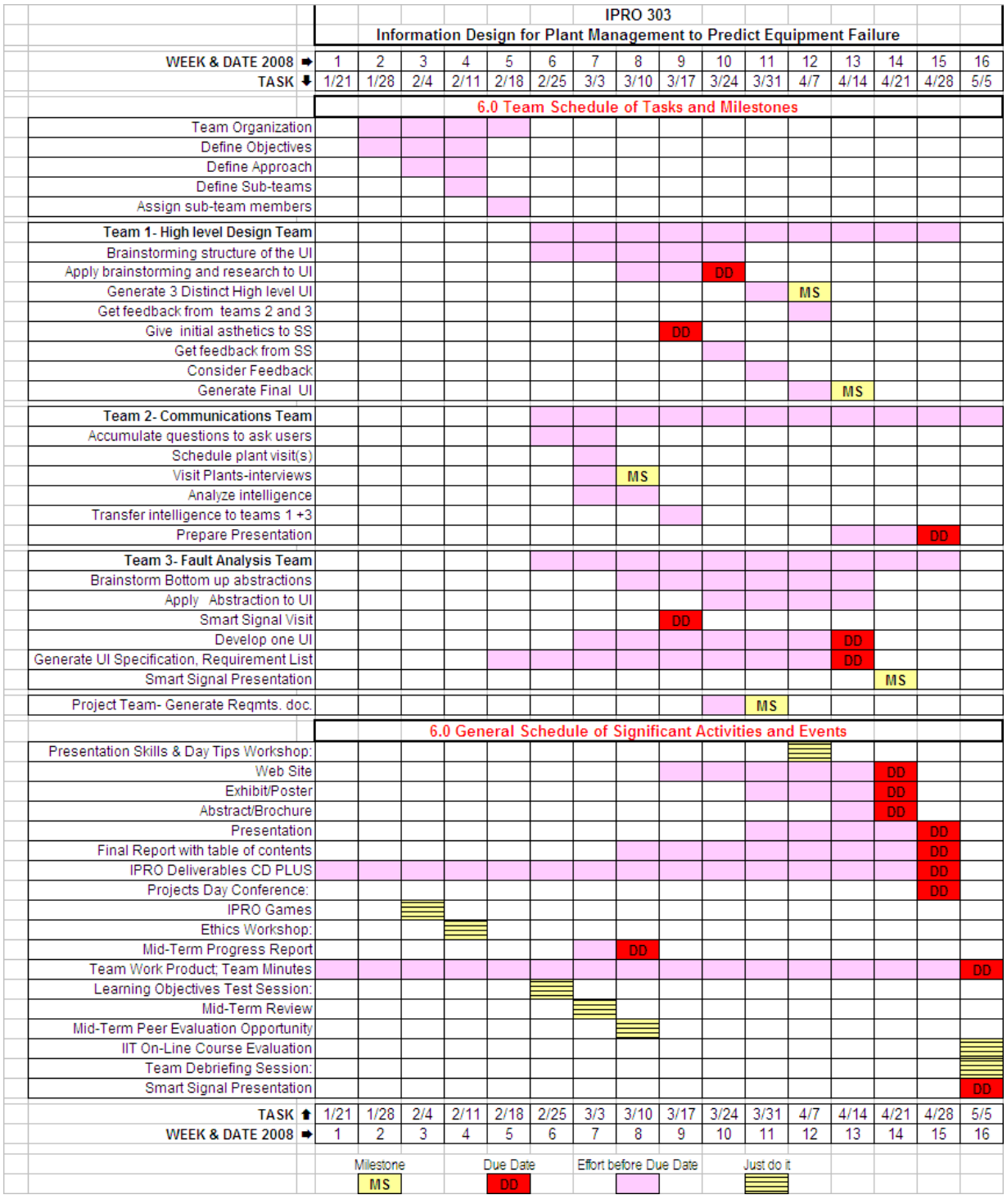
Total	$600

6. Schedule of Tasks and Milestones



Team members responsibilities and tasks

	Team Schedule of Tasks and Milestones
Team Organization	Project Team
Define Objectives	Project Team
Define Approach	Project Team
Define Sub-teams	Project Team
Assign sub-team members	Project Team
Team 1- High level Design Team	
Brainstorming structure of the UI	Team 1
Apply brainstorming and research to UI	Team 1
Generate 3 Distinct High level UI	Haruko, Arthur, Jihyung
Get feedback from teams 2 and 3	Arthur
Give initial asthetics to SS	Haruko
Get feedback from SS	Team 1
Consider Feedback	Team 1
Generate Final UI	Team 1
Team 2- Communications Team	
Accumulate questions to ask users	Team 2
Schedule plant visit(s)	Rachel
Visit Plants-interviews	Team 2
Analyze intelligence	Team 2
Transfer intelligence to teams 1 +3	Rachel
Prepare Presentation	Team 2
Team 3- Fault Analysis Team	
Brainstorm Bottom up abstractions	Team 3
Apply Abstraction to UI	Team 3
Smart Signal Visit	Team 3
Develop one UI	Team 3
enerate UI Specification, Requirement List	Jacob
Smart Signal Presentation	Team 3
Project Team- Generate Reqmts. doc.	Project Team
	General Schedule of Significant Activities and Events
Presentation Skills & Day Tips Workshop:	
Web Site	Lee
Exhibit/Poster	Haruko, Jacob
Abstract/Brochure	Arthur, Ray
Presentation	Haruko, Rachel, Samad
Final Report with table of contents	Nirav, Jihyung
IPRO Deliverables CD PLUS	Arthur
Projects Day Conference:	Team
IPRO Games	Rachel, Lee, Haruko
Ethics Workshop:	Samad, Jacob, Rachel, Arthur
Mid-Term Progress Report	Team
Team Work Product; Team Minutes	Team
Learning Objectives Test Session:	Team
Mid-Term Review	Team
Mid-Term Peer Evaluation Opportunity	Team
IIT On-Line Course Evaluation	Team
Team Debriefing Session:	Team
Smart Signal Presentation	Team

7. Individual Team Member Assignments

A. Overview

Name	Major	Skills / Strength	Work Experience	Sub-Group	Present contributions towards IPRO project
Dodds, Jacob	Architecture	-Designing visual presentations -Programming		Fault analysis	Ethics workshop
Erogbogbo, Samad	Mechanical Engineering	-Computer programming -Visual programming	Student Engineer at Gamma Technology inc.	Fault analysis	Project Plan Ethics workshop
Fleming, Rachel	Biomedical Engineering	-Computer programming -Organizing -Communicating		Communication	Ethics workshop
Fujimoto, Haruko	Architecture	- Designing visual presentations	e22. creative (film production)	High level design	Project management workshop Project plan
Hazariwala, Nirav	Mechanical Engineering	-Computer programming	Best Buy (Geek Squad)	Fault analysis	-Software flow design
Kim, Jihyung	Mechanical Engineering	-Presentation skill -3D drawing skills		High level design	-Managed iGroups e-mails
Lee, Sangwook	Electrical Engineering	-Creating websites -Computer programming	Volunteer at an orphanage	Communication	Project management workshop Project plan
McAnally, Arthur	Computer Science Computer Engineering	-CS theory -Working under pressure		High level design	Ethics workshop -Managed iGroups files -Software flow design
Simons, Ray	Electrical Engineering	-Microsoft Office tool -Computer programming	Managed manufacturing companies Attorney	Communication	Project management workshop Project plan

B. Team Leader

Simons, Ray

C. Sub-teams

Team 1: High - Level Design Team
leader: McAnally, Arthur
members: Kim, Jihyung
Fujimoto, Haruko

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.

8. Designation of Roles

Meeting Roles:

Minute taker: .....Fleming, Rachel
Agenda Maker: .....Simons, Ray
Timekeeper: .....None assigned

Status Roles

Time sheet collector/Summarizer .....None assigned
Master Schedule Maker: .....Simons, Ray
Igroups coordinator:.....McAnally, Arthur – Managing files
.....Kim, Jihyung – Managing e-mails