INFORMATION DESIGN FOR PLANT MANAGEMENT TO PREDICT EQUIPMENT FAILURE

Represented by:
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Chike Obichukwu
Kirsten Reimann
Christian Arnoux

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Team Introduction

Students
- Omar M. Husain
  - Mechanical Engineering
- Harry Michael
  - Mechanical Engineering
- Kirsten Reimann
  - Chemical Engineering
- Ivan Voukadinov
  - Mechanical Engineering
- Richard Ike
  - Mechanical Engineering

Advisor(s)
- Don Chmielewski
  - Chemical Engineering Department
- Chike C. Obichukwu
  - Electrical Engineering
- Christian Arnoux
  - Chemical Engineering
- Femi Sonoiki
  - Mechanical Engineering
- Tania Atanassova
  - Architectural Engineering
- Yewon Lee
  - Computer Science
- Don Tijunelis
  - Industrial Technology & Management
Background

- Smartsignal formed out of Argonne National Laboratory
- They created a software that predicts equipment failure in power plants
- They see that their user interface and alerts was not reaching its full potential
Project Stages

1. Find out who is involved
2. Study those personnel
3. Study & recommend software changes
Objective

- To accomplish a “Day in the Life” Study of Smartsignal’s end user.
- Presenting a comprehensive report to our sponsor.
- Setup a starting point for the next semester.
Benefit

SmartSignal

- Improved understanding of their user
- More competitive product

Power Plant

- Increased safety
- Reduces environmental mishaps
- Increases profitability
Ethical Issues

- Conducting ourselves in a professional manner
  - Very diverse backgrounds of employees in power plant
- Reporting factual data
- Working as a cohesive team
Methodology

- **Create Interviews**
  - Regular duties and involvement in maintenance
  - Current preferred methods of maintenance and failure prevention.
  - Current challenges involving maintenance and monitoring.

- **Contact power plants to schedule interviews and tours.**

- **Analyze interview results expressing majority opinion.**
Team Division

Questionnaire

➢ Develop basic questions
➢ Review questions after subsequent interviews.
➢ Create new questions as required.

Contact

➢ Contact as many coal fired power plants.
➢ Schedule interviews with Eng. Specialist and Shift Supervisors.
➢ Organize Plant tours

Deliverables

➢ Create all IPRO Deliverables.
➢ Timely Submission of IPRO Deliverables
➢ Maintaining Meeting Minutes
➢ Maintain and Update Project Plan.
Other team tasks

- **Conduction of Interviews**
  - Done by the complete team based on time availability.

- **Interview Analysis**
  - Collection of Interviews.
  - Illustrating Majority Opinion using visual aids (Graphs).
  - Listing Conclusions.
## Project Timeline 1 of 2

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
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<tr>
<td>1</td>
<td>Team Organization</td>
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<td>Defining the Objective</td>
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<td>Deciding on an approach</td>
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<td>Creation of Sub Groups based on tasks</td>
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<td>Allotment of Positions</td>
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<td><strong>Questionnaire Team Tasks</strong></td>
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<td>Compile Questions</td>
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<td>Presentation of Questions for team discussion</td>
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<td>Prioritize and Categorize questions</td>
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<td>Review questions with Psychology professor</td>
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<td>Finalize Interview Questions</td>
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<td>Submit Final Questions questions to Interview group</td>
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<td><strong>Contact Team Task</strong></td>
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<td>Research Potential Companies (Coal Power Plants)</td>
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<td>Draft and Review Communication Letter</td>
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<td>Contact 1st Set of Powerplants and set up Interviews</td>
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<td>Schedule Plant tours</td>
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<td>Submit interview schedules to Interviews group</td>
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<td>Contact Second Batch of Powerplants and Set up interviews</td>
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<td>Submit Interview Schedules to Interview groups</td>
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Project Timeline 2 of 2

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<td>Develop Approach to analyze questionnaire answers into meaningful reports</td>
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<td>Receive Completed 1st Batch of Interviews</td>
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<td>Monitor compliance with code of ethics in class</td>
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Data Collection

- Power Plants contacted: 40
- Power Plants Interviewed/Visited: 9
- No of interviews collected: 13
  - Shift Supervisors: 5
  - Engineering Specialist: 8

22.5% positive responses.
Data Analysis

Analysis Procedure

- Selection of relevant points from answers of each interview.
- Tabulation of repetition of answers
- Displaying using bar graphs response of interviewed personnel.

Example:

Question: What are your duties on a typical day on the job?

Answer: Large part of my job is to manage the capital budget; second largest would be to make sure that everything in the plant is operating smoothly. I attend morning & evening meetings in which I get report about any problems, my job is to prioritize and identify if the problem is reoccurring.

Analysis: Capital Budget; Ensure Smooth Operation; Meetings; Problem Reoccurrences Identification; Error Prioritization.
Data Analysis Example 1 of 2

Engineering Specialist’s

Duties:
- Attending Meetings
- Prioritization of Alerts
- Review Plant Performance

60% say: Planned vs Unplanned Maintenance is 50/50% while 40% say its 70/30%
Data Analysis Example 2 of 2

Shift Supervisors

Duties:
- Attend Regular Meetings
- Monitor Plant Operation
- Make work orders

Their priorities if failure occurs:
- Maintain Production to cut cost
- Ensure if there is no Safety hazard
- Ensure if there is no Environmental Hazard (Excessive Emission, Pollution, Excessive water heating (for river cooled plants)
**Next steps**

- After IPRO Day any more work left/ recommendations for future project?

  - Study Past Results
  - Study Smart Signal Software
  - Recommendations for new user interface

  - Detailed Summary of User Interface
  - Re-evaluate Design Recommendations

  - Proposal to Smart Signal/Thesis

  - Completion Of Project
Summary

Key takeaways

- From the beginning to the end of this semester considerable improvement has been seen in the following areas:

  - Communication Skill Development
  - Project Management Skill Development
  - Teamwork Skill Development
  - Innovative Development
Concluding

Long term results:
- Cheaper Energy.
- Safer Power Plant environments.
- Lower pollution.
Acknowledgement

We sincerely acknowledge the contributions of:

- Our faculty advisors
- The power plant staff and management.
- SmartSignal