Information Design for Plant Management to Predict Equipment Failure

Represented by:

Omar M Husain

Chike Obichukwu

Kirsten Reimann

Christian Arnoux

November 30, 2007

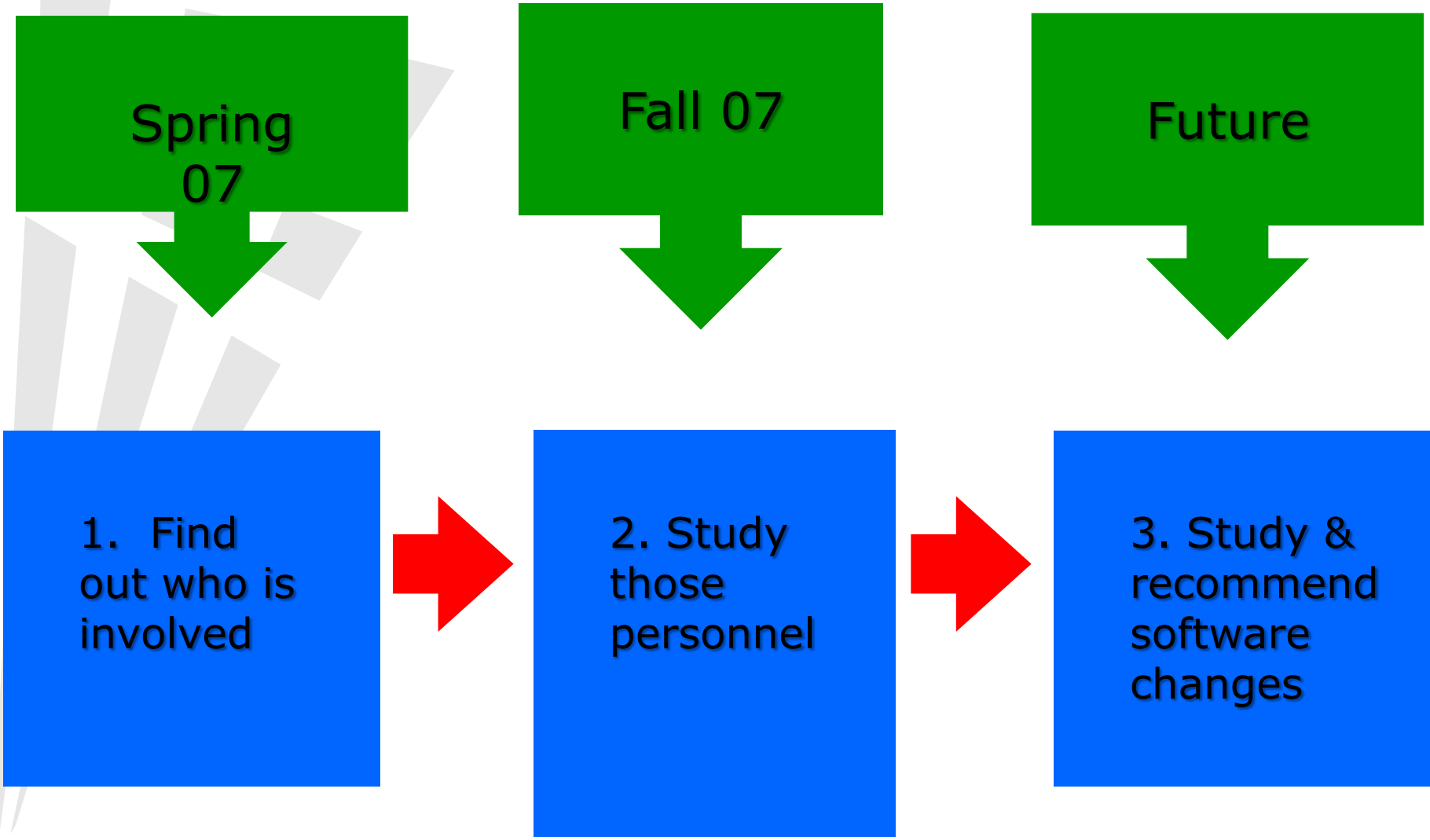
Team Introduction

- Students
  - Omar M. Husain
    - Mechanical Engineering
  - Harry Michael
    - Mechanical Engineering
  - Kirsten Reimann
    - Chemical Engineering
  - Ivan Voukadinov
    - Mechanical Engineering
  - Richard Ike
    - Mechanical Engineering
  - Chike C. Obichukwu
    - Electrical Engineering
  - Christian Arnoux
    - Chemical Engineering
  - Femi Sonoiki
    - Mechanical Engineering
  - Tania Atanassova
    - Architectural Engineering
  - Yewon Lee
    - Computer Science
- Advisor(s)
  - Don Chmielewski
    - Chemical Engineering Department
  - 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



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

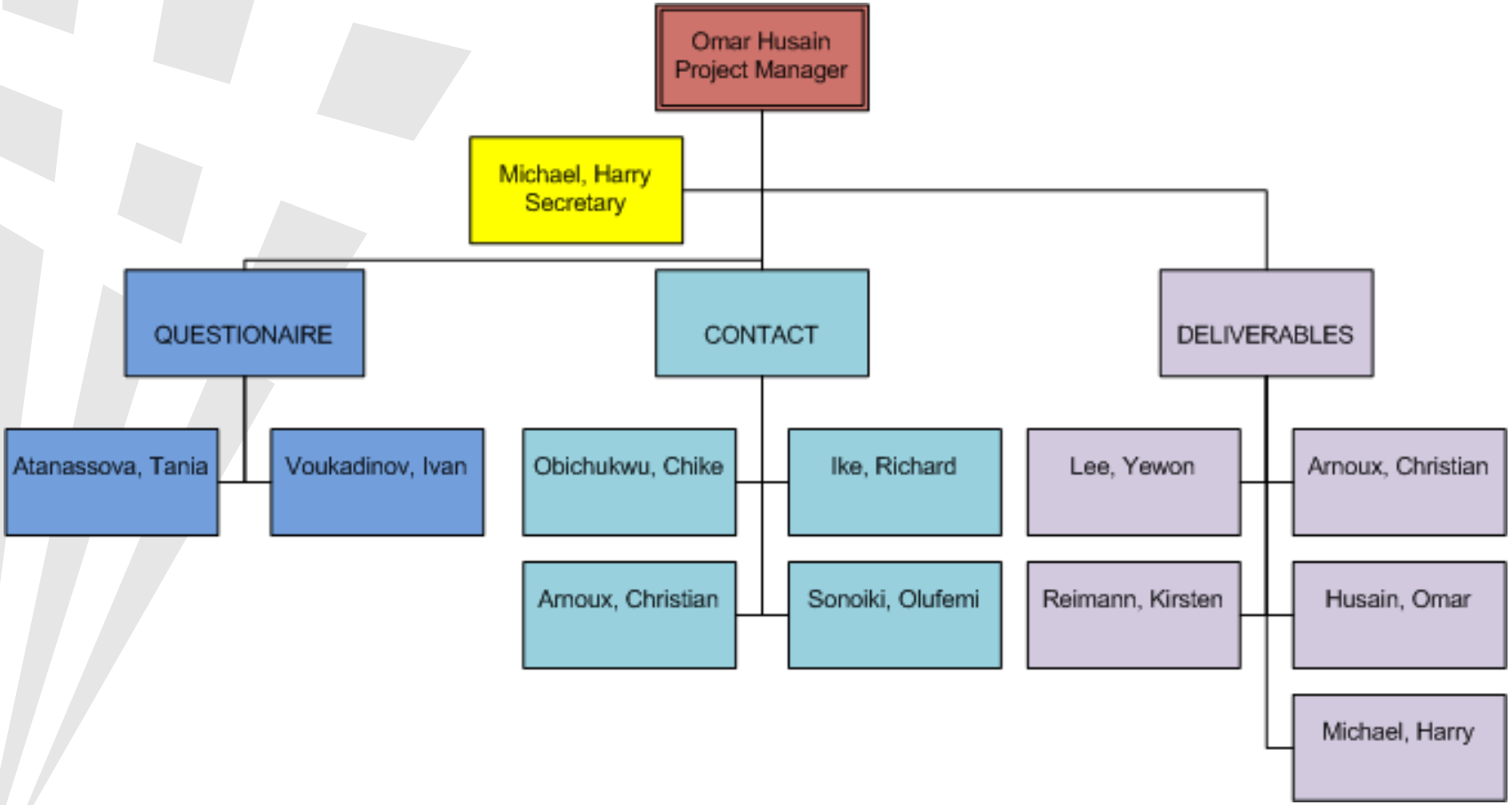
Deliverables

- Create all IPRO Deliverables.
- Timely Submission of IPRO Deliverables
- Maintaining Meeting Minutes
- Maintain and Update Project Plan.

Other team tasks

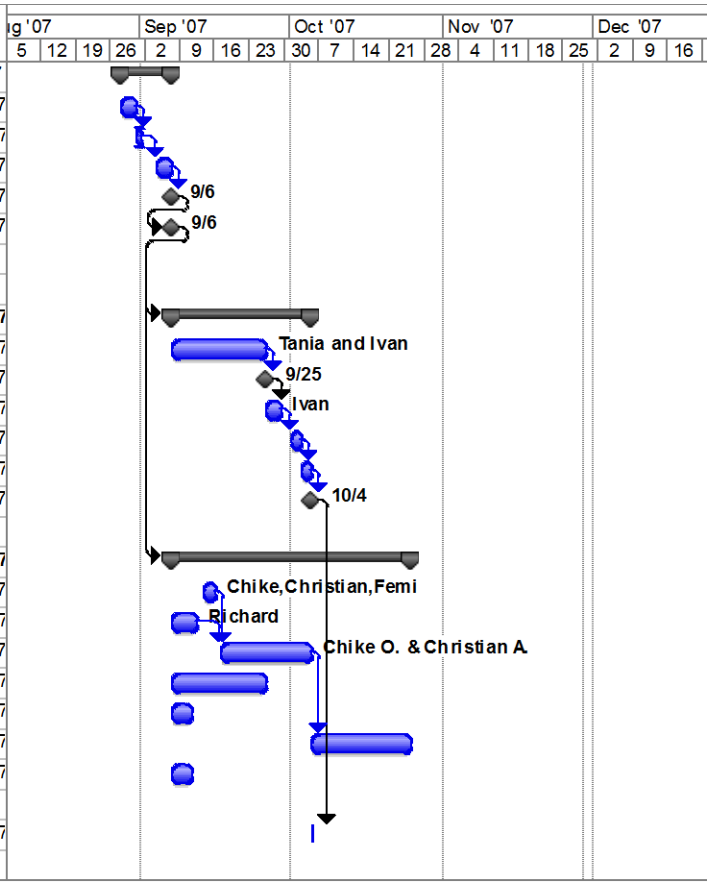
- Conduction of Interviews
  - Done by the complete team based on time availability.
- Interview Analysis
  - Collection of Interviews.
  - Illustrating Majority Opinion using visual aids(Graphs).
  - Listing Conclusions.

Team Member Distribution



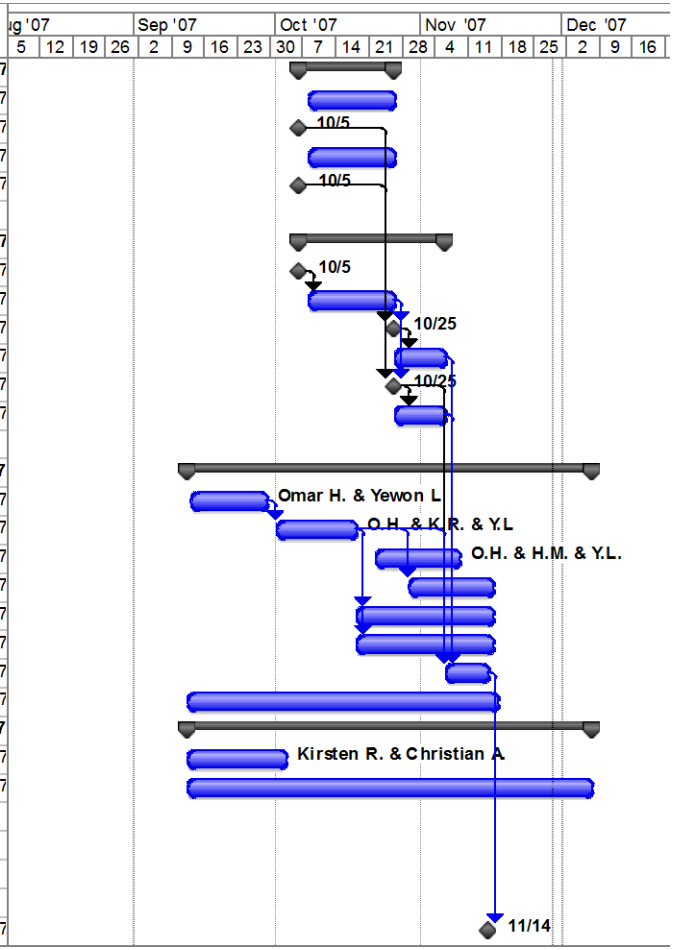
Project Timeline 1 of 2

ID	Task Name	Duration	Start
1	**Team Organization**	**8 days?**	**Tue 8/28/07**
2	Defining the Objective	3 days	Tue 8/28/07
3	Deciding on an approach	1 day	Fri 8/31/07
4	Creation of Sub Groups based on tasks	3 days	Tue 9/4/07
5	Allotment of Positions	0 days?	Thu 9/6/07
6	Team Organizaion Complete	0 days	Thu 9/6/07
7			
8			
9	**Questionaire Team Tasks**	**21 days**	**Fri 9/7/07**
10	Compile Questions	14 days	Fri 9/7/07
11	Presentation of Questions for team discussion	0 days	Tue 9/25/07
12	Prioritize and Categorize questions	3 days	Wed 9/26/07
13	Review questions with Psychology professor	2 days	Mon 10/1/07
14	Finalize Interview Questions	2 days	Wed 10/3/07
15	Submit Final Questions questions to Interview group	0 days	Thu 10/4/07
16			
17	**Contact Team Task**	**35 days**	**Fri 9/7/07**
18	Research Potential Companies (Coal Power Plants)	2.67 days	Thu 9/13/07
19	Draft and Review Communication Letter	3 days	Fri 9/7/07
20	Contact 1st Set of Powerplants and set up Interviews	14 days	Mon 9/17/07
21	Schedule Plant tours	14 days	Fri 9/7/07
22	Submit interview schedules to Interviews group	2 days	Fri 9/7/07
23	Contact Second Batch of Powerplants and Set up interviews	14 days	Fri 10/5/07
24	Submit Interview Schedules to Interview groups	2 days	Fri 9/7/07
25			
26		1 day?	Fri 10/5/07
27			



Project Timeline 2 of 2

ID	Task Name	Duration	Start
28	**Interview tasks**	**14 days**	**Fri 10/5/07**
29	Go to 1st Batch of interview locations and conduct meeting/Interviews	14 days	Mon 10/8/07
30	Submit Interview Results to Analysis group	0 days	Fri 10/5/07
31	Go to 2nd Batch of interview locations and conduct meeting/Interviews	14 days	Mon 10/8/07
32	Submit 2nd Set Interview Results to Analysis group	0 days	Fri 10/5/07
33			
34	**Analysis tasks**	**21 days**	**Fri 10/5/07**
35	Receive present Questionaire	0 days	Fri 10/5/07
36	Develop Approach to analyze questionaire answers into meaningful reports.	14 days	Mon 10/8/07
37	Receive Completed 1st Batch of Interviews	0 days	Thu 10/25/07
38	Analyze 1st Interviews	7 days	Fri 10/26/07
39	Receive 2nd Batch of Interviews	0 days	Thu 10/25/07
40	Analyze 2nd Batch of Interviews	7 days	Fri 10/26/07
41			
42	**Deliverables**	**63 days?**	**Wed 9/12/07**
43	Project Plan	13 days?	Thu 9/13/07
44	Midterm Report	13 days?	Mon 10/1/07
45	Website	14 days	Mon 10/22/07
46	Abstract	14 days	Mon 10/29/07
47	Final Presentation	21 days	Thu 10/18/07
48	Poster	21 days	Thu 10/18/07
49	Final Report	7 days	Tue 11/6/07
50	Compile Minutes and Submit on 11/16	49 days?	Wed 9/12/07
51	**Ethics**	**63 days?**	**Wed 9/12/07**
52	Develop Code of ethics	16 days	Wed 9/12/07
53	Monitor compliance with code of ethics in class	63 days?	Wed 9/12/07
54			
55			
56			
57			
58	***Estimated Completion of Project***	0 days	Wed 11/14/07



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.

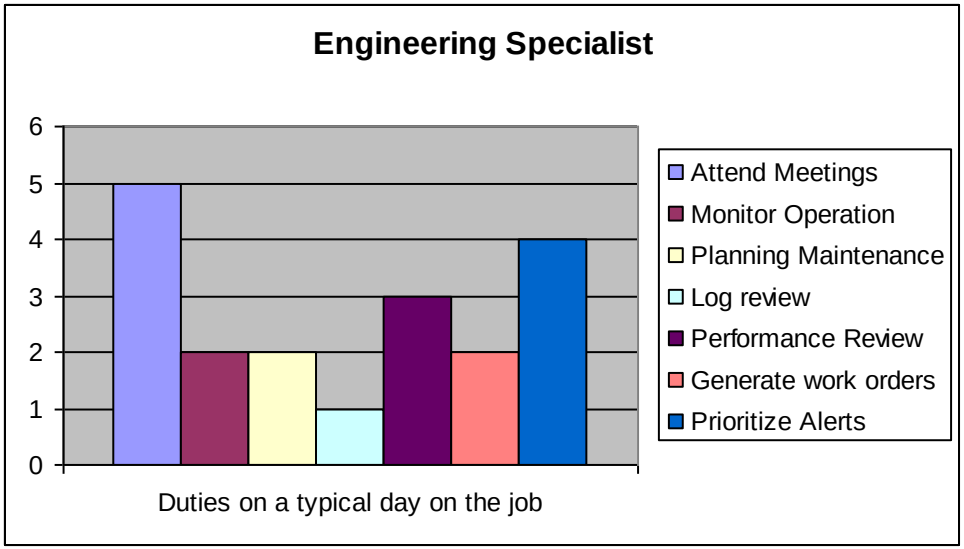
Data Analysis Example 1 of 2

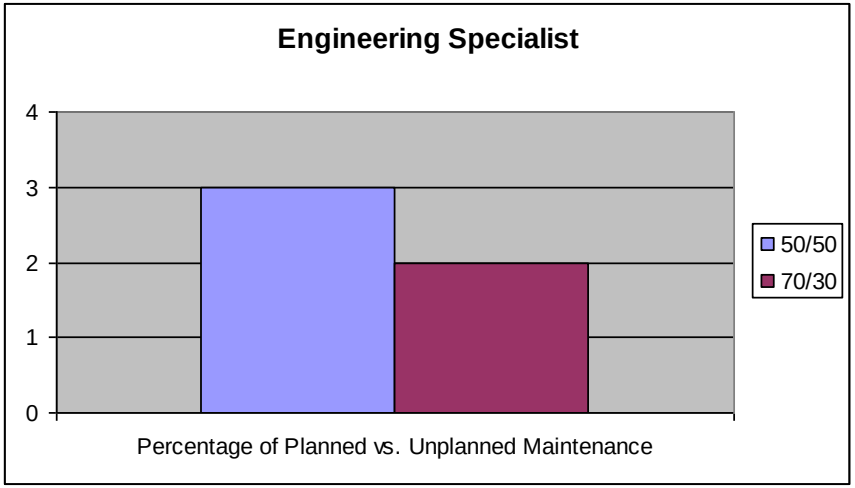
Engineering Specialist's

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

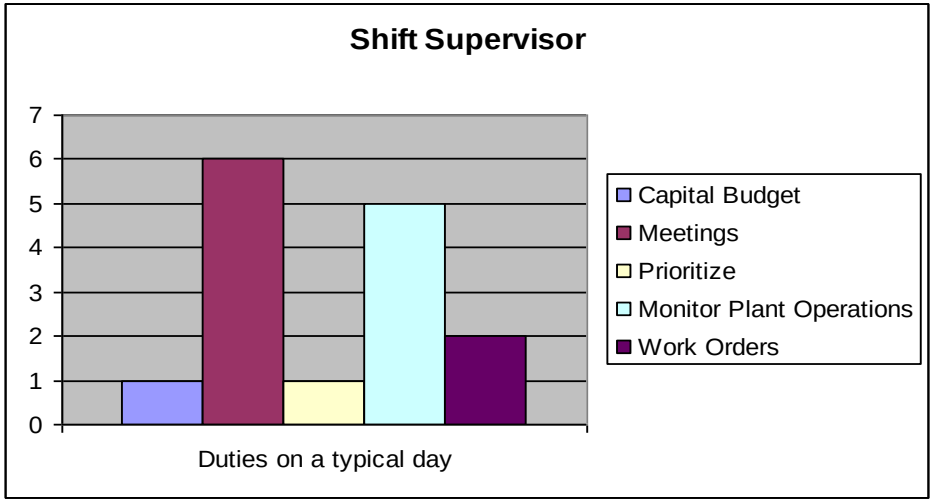
Shift Supervisors

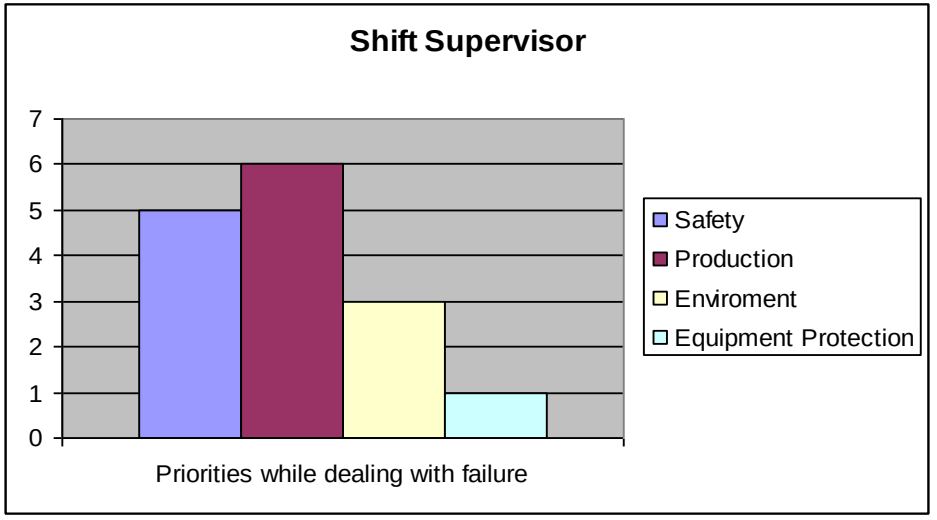
Duties:

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

Their priorities if failure occurs:

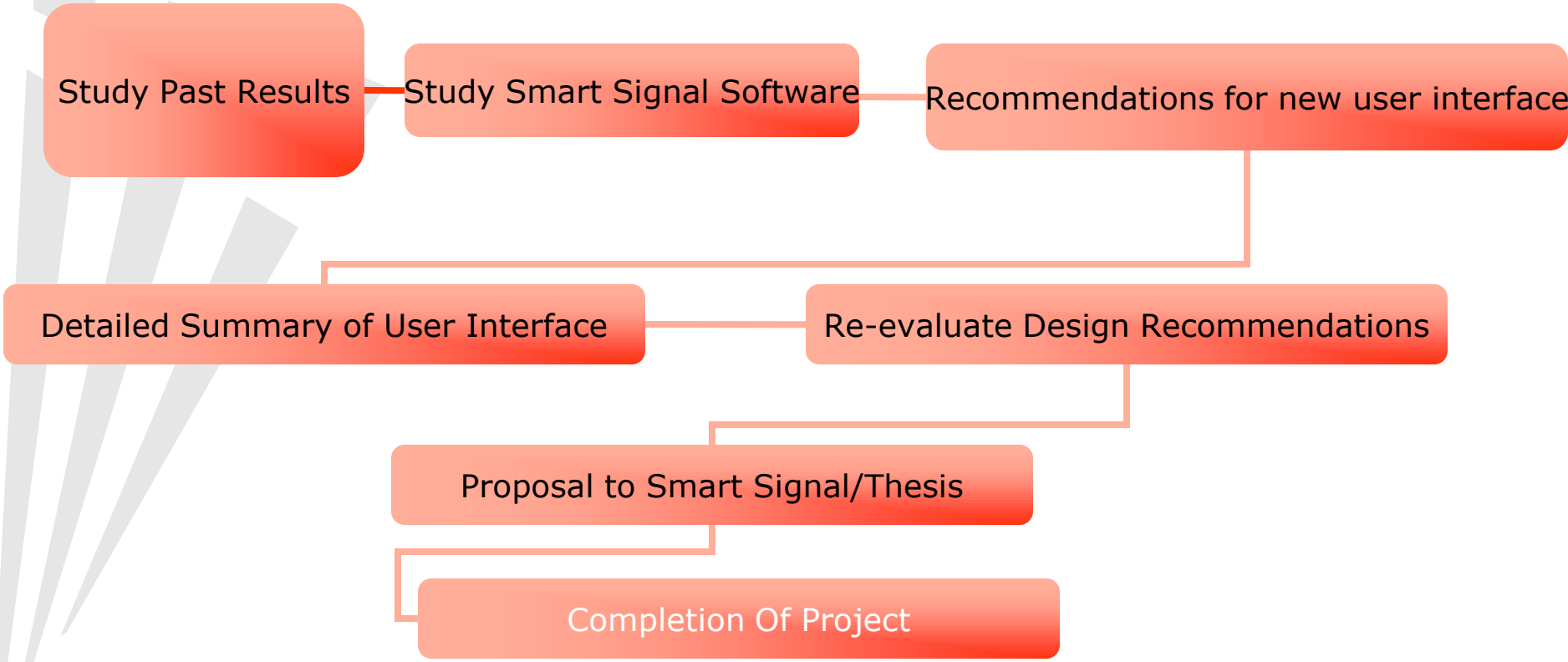
- Maintain Production to cut cost
- Ensure if there is no Safety hazard
- Ensure if there is no Environmental Hazard (Excessive Emission, Pollution, Excessive water heating (for river cooled plants)





Next steps

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



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