IPRO 304
Fall 2008

Innovating Process Improvements in Manufacturing Operations

Advisors: William Maurer
Sheldon Mostovoy

Sponsor: A. Finkl & Sons Co.

Team: Asad Akram
Talha Bhatti
Yvonne Hernandez
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Zhenlin (William) Lu
Vien Quach
Philip Siu
Jan Teves
Seth Thomas
Min Zheng

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1. Abstract

A. The purpose of this IPRO is to develop a robust, working prototype that can automatically monitor and detect a problem with a milling machine at A. FInkl & Sons Co. This IPRO is in its fourth semester and there are two challenges remaining: (1) alerting management to the detection of broken teeth during machining; and (2) developing spatial representations of items undergoing heat treatment. However, A. Finkl & Sons has asked us to concentrate solely on the goal of finding a way to detect when a break occurs in one of the milling teeth and then alert the mechanic monitoring the machine in order to replace it. This system will involve measuring vibrations using an accelerometer or by the use of laser detection. The goal of this IPRO is to research, test, and inform A. FInkl & Sons of the best solution to invest in, therefore they can decide what is better for their company.

2. Background

A. The project customer is A. Finkl & Sons Co. which is looking for a way to detect a break in their milling machine, so that it can be replaced quickly and efficiently.

B. The problem that A. FInkl & Sons wants us to concentrate on is that of the detection of broken teeth on their milling machine. Milling machines are used to cut and finish metal. A rotating head on the milling machine has a number of inserts, also referred to as teeth, which cut the material as it rotates. The material moves under the rotating head so that the entire surface can be milled. The mills are used to remove material of large forged steel parts to properly fit the customer's specifications.

   Currently, A. Finkl & Sons keeps an operator by the mill when it is running and that person is in charge of turning off the mill when a tooth breaks. The only form of detecting if a tooth has broken is to constantly check the solid piece of steel for any unusual marks. This form of checking is too long, because most mistakes will not be noticed until after a long while and then the operator has to check every single tooth on the rotating head. If the broken tooth is not fixed or noticed in time, it presents drastic problems. By having one tooth that breaks while milling, it causes strain on the milling machine and more weight on the other milling teeth, therefore causing more inserts or teeth to be susceptible to breaking as well. By finding a solution to better detect when an insert breaks, it will save A. Finkl & Sons much time and money, enabling them to manufacture more quantity of pieces and better quality.

C. The existing technology that we have coming into the IPRO is all the preliminary research. We are focusing on two main ideas as to how to

approach the problem of detecting a tooth breakage in the machine. The use of accelerometers to measure vibrations and the detection by laser. The existing technology to date, is that of the group broken down into subgroups.

The first technology we are focusing on is the accelerometer. There are two aspects to the accelerometer technology, wireless or wired. One is a wireless accelerometer provided by Techkor, which seems to be the best option. There were a few companies that were investigated, for example, Honeywell and G-Link. However, Techkor is the better of the three because the G-Link is too slow for the required frequency. Honeywell has not answered our inquiries at the moment. We have a high frequency issue and Techkor is the only one that demonstrates the capacity that we need on measuring vibrations.

We also have investigated and sought out help for building our own wired accelerometer. There is an uncertainty if we may have the best results with a wireless accelerometer, therefore it was suggested to us that we build our own accelerometer in order to obtain the maximum results. We can purchase a wired accelerometer and an 18 series PIC chip to store data on the machine during normal and broken teeth situations. By using the PIC chip we can gather more data and properly analyze it. If we do not witness a spike in the frequency then we can rule out accelerometers all together.

Thru several interviews with experts in this area, as well as direct contact with other companies with similar problems, we were informed that possibly laser detection may be a different route. Basically, a laser beam will count the teeth on the milling head and an alarm will sound. There is a laser provided by Renishaw that may be able to detect tooth breakage.

A major conflict with using the accelerometer is that it measures vibrations. Therefore we must be accounting for all the factors that will cause vibrations in the factory at the moment of data recording. These are some problems we hope to solve in our IPRO.

3. Objectives

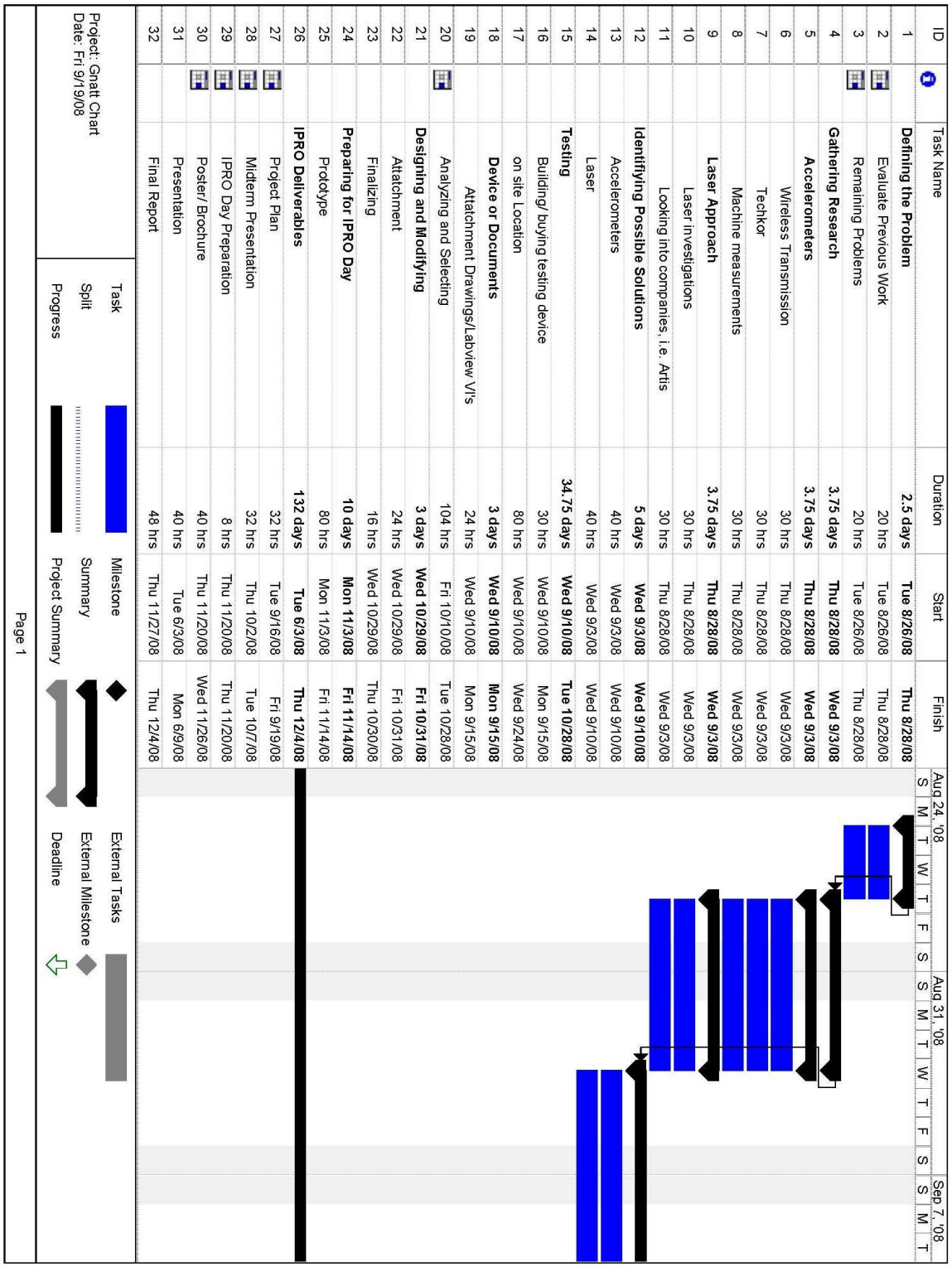
A. Our objectives are testing the validity of the wireless accelerometer, the wired accelerometer and the laser detection. Then providing A. Finkl & Sons with the proper data so that they can decide what they want to use in their factory.

B. For the wireless accelerometer we would like to purchase one immediately to start recording data. However, it is a high priced item. We would need the approval of A. Finkl & Sons to purchase it with their funding in order to experiment.

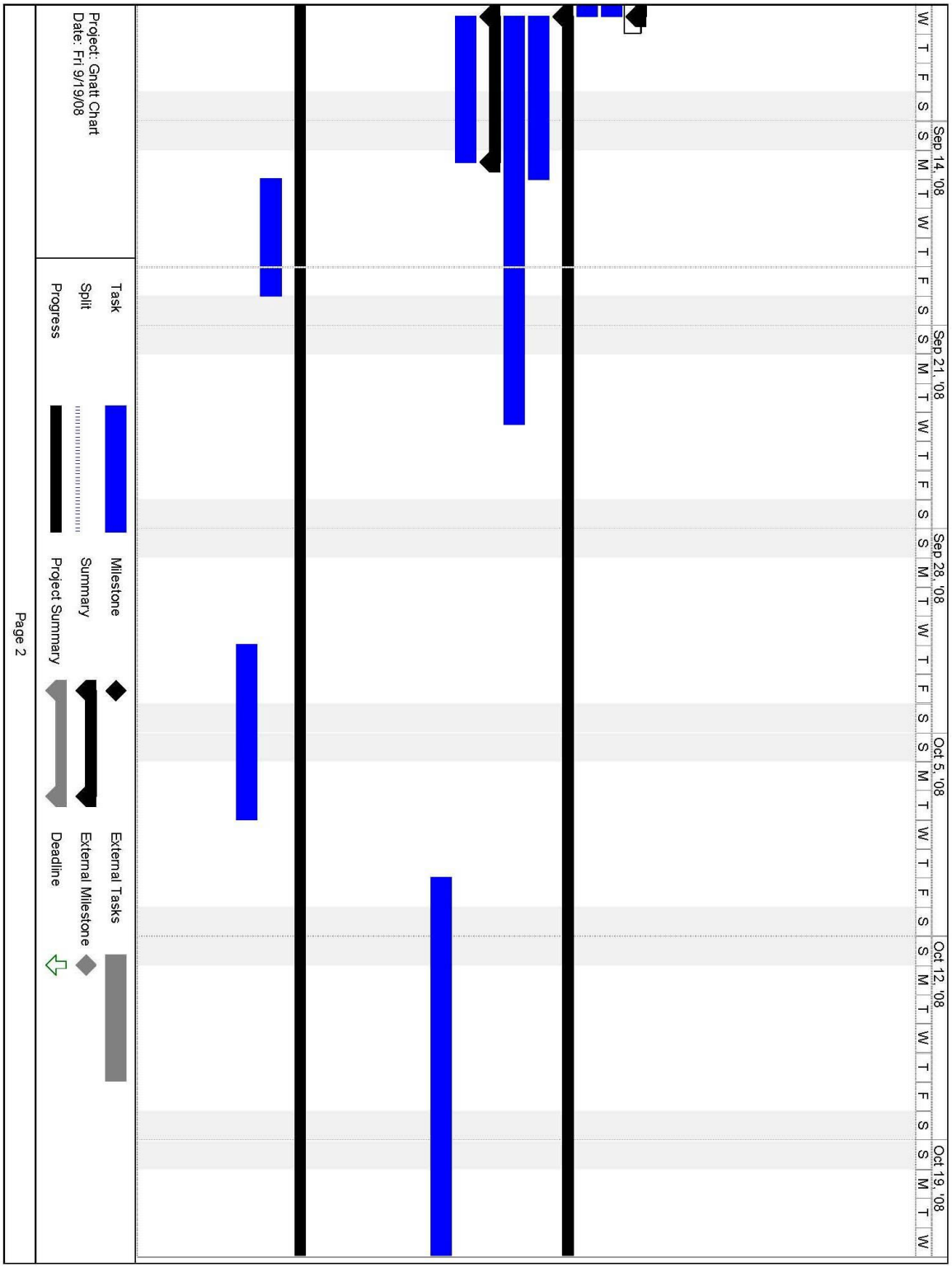
C. For the wired accelerometer we will also purchase the parts to see if it works better or at pace with the wireless system. This is the cheaper option and we would like to compare its effectiveness with the wireless method.

D. As for the laser detection, we would like to continue investigating with other companies and gather as much statistics as possible.

4. Methodology



ID	Task Name	Duration	Start	Finish
1	**Defining the Problem**	**2.5 days**	**Tue 8/26/08**	**Thu 8/28/08**
2	Evaluate Previous Work	20 hrs	Tue 8/26/08	Thu 8/28/08
3	Remaining Problems	20 hrs	Tue 8/26/08	Thu 8/28/08
4	**Gathering Research**	**3.75 days**	**Thu 8/28/08**	**Wed 9/3/08**
5	**Accelerometers**	**3.75 days**	**Thu 8/28/08**	**Wed 9/3/08**
6	Wireless Transmission	30 hrs	Thu 8/28/08	Wed 9/3/08
7	Techkor	30 hrs	Thu 8/28/08	Wed 9/3/08
8	Machine measurements	30 hrs	Thu 8/28/08	Wed 9/3/08
9	**Laser Approach**	**3.75 days**	**Thu 8/28/08**	**Wed 9/3/08**
10	Laser investigations	30 hrs	Thu 8/28/08	Wed 9/3/08
11	Looking into companies, i.e. Artis	30 hrs	Thu 8/28/08	Wed 9/3/08
12	**Identifying Possible Solutions**	**5 days**	**Wed 9/3/08**	**Wed 9/10/08**
13	Accelerometers	40 hrs	Wed 9/3/08	Wed 9/10/08
14	Laser	40 hrs	Wed 9/3/08	Wed 9/10/08
15	**Testing**	**34.75 days**	**Wed 9/10/08**	**Tue 10/28/08**
16	Building/ buying testing device	30 hrs	Wed 9/10/08	Mon 9/15/08
17	on site Location	80 hrs	Wed 9/10/08	Wed 9/24/08
18	**Device or Documents**	**3 days**	**Wed 9/10/08**	**Mon 9/15/08**
19	Attatchment Drawings/Labview VI's	24 hrs	Wed 9/10/08	Mon 9/15/08
20	Analyzing and Selecting	104 hrs	Fri 10/10/08	Tue 10/28/08
21	**Designing and Modifying**	**3 days**	**Wed 10/29/08**	**Fri 10/31/08**
22	Attatchment	24 hrs	Wed 10/29/08	Fri 10/31/08
23	Finalizing	16 hrs	Wed 10/29/08	Thu 10/30/08
24	**Preparing for IPRO Day**	**10 days**	**Mon 11/3/08**	**Fri 11/14/08**
25	Prototype	80 hrs	Mon 11/3/08	Fri 11/14/08
26	**IPRO Deliverables**	**132 days**	**Tue 6/3/08**	**Thu 12/4/08**
27	Project Plan	32 hrs	Tue 9/16/08	Fri 9/19/08
28	Midterm Presentation	32 hrs	Thu 10/2/08	Tue 10/7/08
29	IPRO Day Preparation	8 hrs	Thu 11/20/08	Thu 11/20/08
30	Poster/ Brochure	40 hrs	Thu 11/20/08	Wed 11/26/08
31	Presentation	40 hrs	Tue 6/3/08	Mon 6/9/08
32	Final Report	48 hrs	Thu 11/27/08	Thu 12/4/08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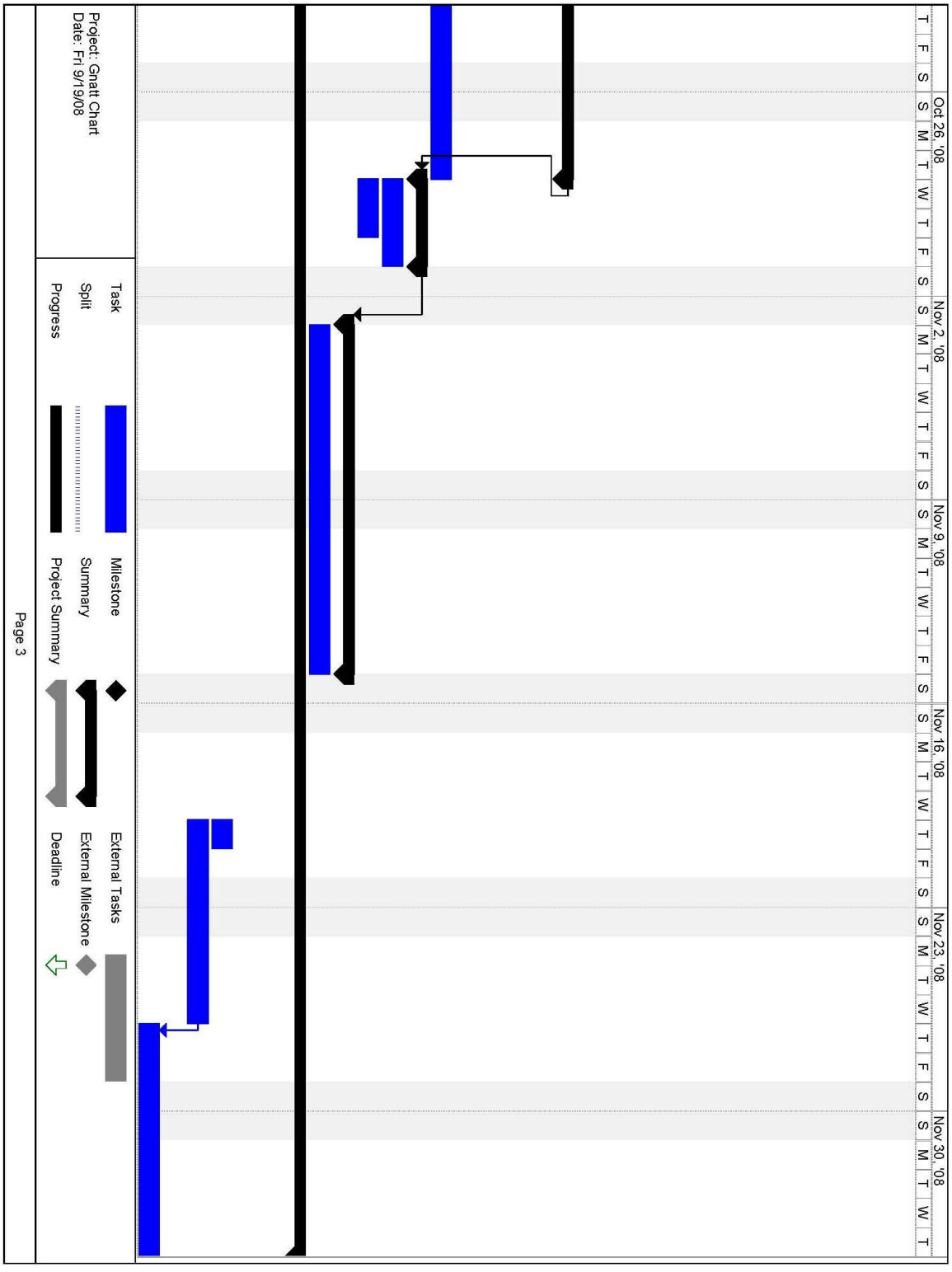
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5. Project Budget

-Travel (to A. Finkl):	$10 per car	x 3 cars	= $30
		x 8 trips	=$240
-Wired Accelerometer:	$200	electronic components, accelerometer, PIC Chip, wireless Transmitter receiver	

Accelerometer = $100
PIC chip = $20
Electronic components, etc. = $80

-Wireless Accelerometer:	$4999	Techkor
	(To be funded by A. Finkl & Sons)	

TOTAL for IPRO: $440 (could be rounded to $500 for unaccounted items)

Total for A. Finkl = $4999

6. Team Structure and Assignments

A.

Name	Major, Year	Skills & Strengths	Team
Akram, Asad	EECE, Senior	Communication Skills, Electrical and Computer Engineering	Accelerometer investigation, Wireless Transmission
Bhatti, Talha	EECE, Senior	Data processing, Electrical and Computer Engineering	Laser Measuring system, Wireless Transmission
Hernandez, Yvonne	Architecture, 5th year	Microsoft Office, good organizational skills	IPRO Organizer; Meeting minutes, project planner, project/enforce deadlines
Kaneria, Satyam	EECE, Senior	Electrical and Computer Engineering	Wireless Transmission
Kerstens, Wesley	MMAE	Microsoft Office, Mechanical Engineering	Drawing of attachment, Aquire data
Khaliqdina, Shahmeer	Electrical Engineering, Junior	Acquiring data, Electrical Engineering	Obtaining precedents, Techkor
Lu, Zhenlin	Finance, Senior	Microsoft Project and good in business direction	IPRO Organizer
Quach, Vien	MMAE	LabView, Mechanical and Materials Engineering	LabView VI's, Drawing of attachment
Siu, Philip	ME & AE, Junior	Mechanical and Materials Engineering	Drawing of attachment, Aquire data, Wireless Transmission
Teves, Jan	Mechanical/ Aerospace Engineering, Senior	Data processing, Microsoft office, Mechanical Engineering	Techkor
Thomas, Seth	MMAE	Microsoft Office, LabView, Mechanical and Materials Engineering	Accelerometer Investigation, LabView VI's, Drawing of attachment
Zheng, Min	CHBE	MATLAB, Organizational skills, Engineering Comprehension	Laser Measuring System

B. There are seven parallel sub teams in IPRO 304 to work on seven different issues, but toward the same big goal together.

Team: IPRO Organization	Yvonne Hernandez -Leader Zhenlin Lu
Team: Wireless Transmission	Asad Akram - Leader Talha Bhatti Satyam Kaneria Shahmeer Khaliqdina Jan Teves
Team: Wired Transmission	Seth Thomas – Leader Wesley Kerstens
Team: Attachment drawings	Vien Quach- Leader Seth Thomas Philip Siu
Team: Laser	Min Zheng - Leader Talha Bhatti Philip Siu
Team: Data	Philip Siu – Leader Jan Teves
Team: LabView	Vien Quach - Leader Seth Thomas

C.

Minute taker: Yvonne Hernandez
Agenda maker: Yvonne Hernandez
Time Keeper: Zhenlin Lu
Summarizer: Zhenlin Lu
Master Schedule: Yvonne Hernandez
IGROUPS: Yvonne Hernandez