

## IPRO 331 Project Plan

### Objectives:

The purpose of this IPRO is to develop a system to automatically detect a problem with a mill at A. Finkl & Sons Co. The system will either turn the mill off or warn the operator when a tooth breaks, or some other irregularity occurs. This system will involve measuring vibration, sound, power, or some combination of these variables. This will replace the current setup, which involves an operator staying in close proximity to the mill to turn it off when a tooth breaks or any other irregularity occurs.

### Background:

Milling machines are used to cut and finish metal. A rotating head has a number of teeth that cut the material as it rotates. The material moves under the mill so the entire surface can be milled. The mill being used for this project is used to improve the surface finish of large forged steel parts.

Finkl currently keeps an operator by the mill when it is running, and that person will turn off the mill if a tooth breaks, or some other problem occurs. That person's time would be better spent operating several machines, rather than sitting by one waiting for a tooth to break.

### Plan:

Several members of the IPRO are tasked with researching current methods of automatically turning off milling machines.

The first step is for Finkl to make their mill operational. It has not been running since the semester started, and therefore we do not have the information and data we need. There is already a vibrometer attached to the mill. However, the data cannot currently be stored. There is an existing PLC capable of storing data, so it will be programmed and set up to record the vibration data.

Finkl will purchase a camera and microphone of our choice. The camera and microphone will be connected to the internet so the IPRO can monitor the mill remotely.

In addition, a new power meter will be purchased to monitor power consumption, since the mill should require more power when a tooth is broken. The current power meter has a very low sampling rate of time per minute. Real-time data is necessary for our application.

The data from the vibrometer, microphone, and power meter will be analyzed and undergo signal processing. The camera will be used as a reference to know when the signals are "normal" and when a problem has occurred. Based on this information,

thresholds can be set. When the signals are out of the normal operating range, either an alarm will sound, or the system will be turned off.

Since our progress is largely dependent on Finkl's cooperation, a schedule cannot be made at this time.

#### Project Budget:

This IPRO will require the purchase of a microphone, camera, and power meter. Signal processing software may also be necessary. Exact values are not yet available, but Finkl will be responsible for purchasing the equipment. Anything Finkl cannot supply will be purchased out of the budget. Also, every attempt to use the resources of IIT labs will be made before the purchase of any equipment.

#### Expected Results:

The mill vibration, noise, and power consumption will vary when a tooth is broken. One or more of these variables will be monitored. This IPRO will result in a system that determines when the mill is outside normal operating conditions.