

# IPRO 321

# PRODUCT DEVELOPMENT AND TESTING OF PAPER SHREDDER INNOVATIONS

## Team

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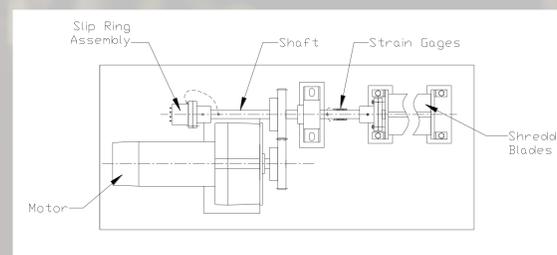
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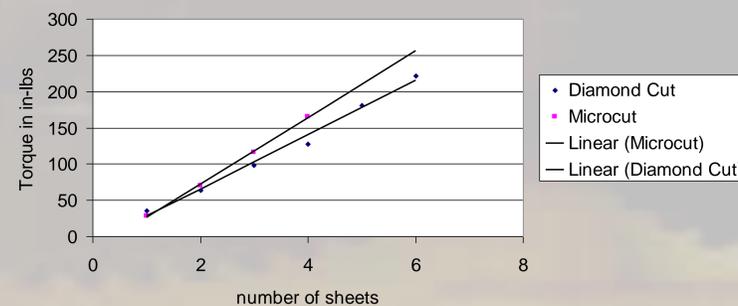
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## Mechanical Torque

- A testing apparatus was designed and created that utilizes strain gage rosettes to provide an accurate measure of the applied torque.
- The device was calibrated using known weights applied with a measured moment arm. The resulting calibration constant provides a direct link between output voltage and torque, allowing computer software to record the testing data.
- This was done for three different types of cuts and the data was analyzed. The resulting data was then used in the prototype design.



Micro cut vs Diamond cut

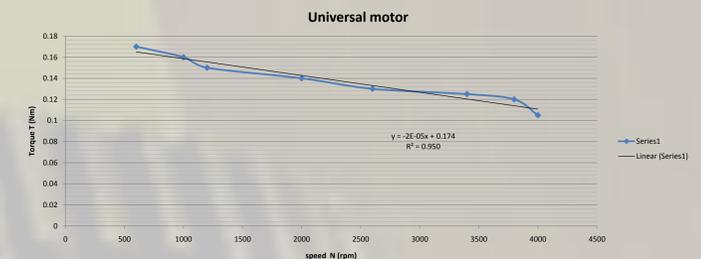
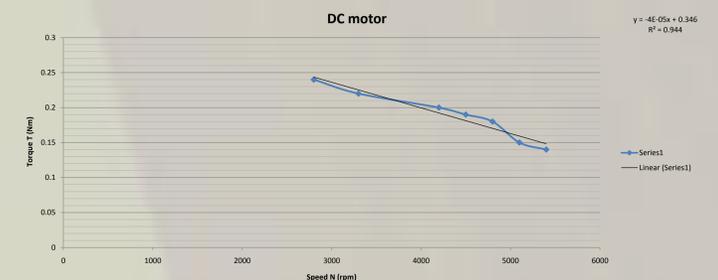


## Gears

- Research was done on the different gear types to determine which best suits the paper shredder.
- Using data from the torque analysis of each shredder cut, along with the motor data, an ideal speed reduction was calculated.

## Electrical

- The motors were hooked up to a dyno-meter designed to measure the horsepower of the motor
- The pitch on the gear protruding from the motor was measured to help with the design of the gear train
- This was done for three types of motors and the data was analyzed. The resulting data was then used in the prototype designed



## Background

• IPRO 321 is sponsored by The Manhattan Group. Mr. Lewis, the President of the company, initiated the IPRO by asking IIT students to help improve the performance and reliability of the Royal brand paper shredder. For this semester, the objective of the Ipro is to develop a prototype paper shredder.

• There are numerous kinds of paper shredders available in the market today. Offices, homes, schools, etc. have been increasingly using paper shredders to safely dispose of important documents, CDs, credit cards, etc. However, the need for progress is evident. Most paper shredders are noisy as well as expensive. Customers are demanding better paper shredders in terms of cost and efficiency.

## Objectives

- TEST VARIOUS SHREDDER HEADS – Determine the amount of torque needed to cut various amounts of 20 lb paper using three different types of cut. The types used were micro-cut, diamond cut, and cross-cut.
- TEST VARIOUS MOTORS – Determine the horsepower the motor outputted while running the paper shredder and the torque it puts into the gear train
- DEVELOP GEAR TRAIN – Design an efficient gear train that optimizes the number of gears and minimizes the motor size necessary to withstand 500 cycles at maximum sheet capacity.
- CONSTRUCT PROTOTYPE – Using data collected, a working model was constructed.

## Innovation

- Extract a printer's paper feeding mechanism to incorporate with a relatively simple shredding apparatus.
- Remove rotating shredder blades in place of either rotating hole punchers or stationary blades to improve energy efficiency and lower noise level.

## Recommendations

- The prototype paper shredder can be used to interchange different motors and shredder heads to test different designs.
- The gear train can be changed to non-metallic to decrease noise.
- A DC motor would be the best type of motor to run the prototype paper shredder
- Implementing an automatic paper feeder coupled with non-rotating shredding blades could improve paper shredding efficiency and customer satisfaction.