Project Plan
IPRO 321 Spring 2007

Advisors
Mr. Maurer
Dr. Mostovoy

1. Objective

The objective of this team will be to improve safety, performance and evaluate/design an implementation for the reduction of noise emission from the sample of Paper Shredder Prototypes provided to us by "The Manhattan Group", project sponsor. Another objective of this team is to evaluate the current market offerings and price points and create new industrial designs for a line of paper shredders that could be sold at retail stores such as Staples, Target, or Office Depot. Designs should focus on a new feature or style.

2. Goals

Sound Reduction- To reduce the output of auditable frequencies so as to affect an overall decrease in noise production of at least 10 Decibels as measured from approximately 6 inches from the Paper Shredder.

Safety- The goal of this sub-team is to ensure that the safety features pass the 2007 UL standards and to enhance all of the safety factors of each paper shredders provided. Our top priority is to test the machines possibilities of physical harm especially finger injuries since it has been an issue to young children with past models.

Performance – The goal is to provide the company with alternative designs for the shredder to increase performance and reliability. These will include alternative designs as well as material upgrades

Primary to All Evaluation, Implementation, and Integration issues will be the need to maintain Cost Effectiveness, Reliability, and Consumer Friendly Final Design.

3. Alternatives

Sound- Research and evaluation will proceed along three different paths: Active Noise Reduction, Passive Noise Reduction, and Noise Dampening.

Safety- There are no alternatives to this project because if the paper shredders do not pass the 2007 UL standards they cannot go on the market

Performance – The team intends to either provide a more efficient paper shredder mechanism, or suggest different materials to be used in crucial points.

3.1 Active Noise Reduction

Active Noise Cancellation is the method in which Noise Output is reduced through electronic or mechanical means and varied dynamically feedback from the Shredder itself.

3.2 Passive Noise Reduction

Passive Noise Cancellation is the method of Noise Reduction through electronic or mechanical means without the aid of feedback from the Shredder itself.

3.3 Noise Dampening

Noise Dampening is the method of Reducing Noise output by dampening the production of noise, and/or preventing it's transmission outside of the Shredder Housing.

4 Tasks

Design Task Breakdown is as follows:

Analyze current market

First research all existing models from different companies including international products. Then the team will make out a kind of report that includes prices and design aspects of those models. Also the team will compare the products from our sponsor with other paper shredders in terms of design define competitiveness and drawbacks. The team will visit actual retail stores to check what is popular and so on.

As furniture, the team will check the trends of the furniture and find the design aspects of popular ones. Innovative and attractive industrial design and famous designer must be included in our research.

Gather data to design new one

The team will research various design and colors and trends of machines or furniture for home and office use. If necessary, the team will do survey with appropriate potential and current consumers.

Create and test new design

With the result from research, the team will suggest creative design and features that can be helpful to new product. This design and features should meet UL standards of safety. If possible, the team will create a graphical prototype and make proposals to our sponsor continuously. New design and features have to satisfy the values that sponsor pursues. The team will survey with created design and features with active users.

Complement weak points and propose final design

Weak points or defects found during test or survey will be complemented during this process. The team will continuously show updated designs to the sponsors and based on their feedback choose the final design.

Deliverables

Finally the team will present its finally designs and features to the sponsors and the IIT community.

Sound Task Breakdown is as follows:

- Evaluate and characterize noise production of unit as a while, under no-load, and load conditions.

- Evaluate and characterize noise production of each major component under ideal and real life operating conditions.
- Identify candidates for Noise Reduction, and propose Individual solutions to noise generation issues.
- Design, Implement, and Test Noise Reduction Methods for each Identified noise Producing Component.
- Design, Implement, and Test Noise Reduction Methods for the Unit as a whole.
- Integrate and Test prototype Utilizing Implementations of Noise Reduction methods Identified Above.

Safety Task Breakdown is as follows:

- Read over 2007 UL Standards
- Find problems with competing company's paper shredders
- Create a list of safety hazards
- Test possible safety hazards on each model
- Formulate new enhanced designs

5. Timeframe

Current timeframe dictates the completion of all above listed tasks before the termination of the Spring 2007 Semester.

6. Resources

Resources identified as being beneficial to the completion of this project are as follows:

- Physical to one or more models of Paper Shredders Candidate for Acoustic Reduction and/or technical Designs of Candidate Paper Shredders.
- Primary Components used in one or more of the Candidate models of Paper Shredder. Primary Components include, but are not limited do: Motor, Drive Train, Cutting Surfaces, and Housings.
- Access to basic Acoustic recording and analysis Equipment.
- Access to other components and facilities to be determined as project progresses.
- Physical models of the different Paper Shredders
- Professor Mostovoy will be another very useful resource for the safety testing
- The 2007 UL Standards for paper shredders

7. Milestones

Initial Milestone Set is proposed below. Addition or modification of existing milestones, as well as the possible cancellation of previous proposed milestones are likely to occur through the project's lifetime:

Safety Milestones

- 02/14/2007 – 2007 UL Standards read
- 02/21/2007 – List of tests
- 03/05/2007 – Meet with sponsor
- 03/21/2007 – 1st tests completed
- 04/04/2007 – New designs created
- 04/18/2007 – 2nd tests completed
- 04/25/2007 – Final model completed

Performance Milestones

- 02/14/2007 – Examination of General Paper Shredder Components
- 02/21/2007 – Design tools to Measure the Torque
- 03/05/2007 – Meet with sponsor
- 03/10/2007 – Design a Mechanism to Break Gears
- 03/21/2007 – Have Torque Measurements Taken for each Shredder
- 03/23/2007 – Determine Composition of Gears
- 03/25/2007 – Measure Torque needed to strip gear
- 04/01/2007 – Know alternatives for gears
- 04/04/2007 – New designs created
- 04/18/2007 – 2nd tests completed
- 04/25/2007 – Final model completed

General Acoustic Evaluation and Characterization Milestone

- Description: This Milestone Represents initial familiarization with the noise output properties of provided Models of Paper Shredder.
- Assigned to: Entire Sub-Team
- Dependencies: Resources only
- Priority: High
- Deliverable: Quality recording and/or spectral analysis of the Protoype models of Paper shredder as recorded under No-Load and Load conditions.
- Due Date:

Component Acoustic Evaluation and Characterization Milestone

- Description: This Milestone Represents initial familiarization with the noise output of each individual noise producing component in one or more model of provided Models of Paper Shredder.
- Assigned to: Unknown
- Dependencies: Resources, General Acoustic Evaluation and Characterization Milestone
- Priority: High
- Deliverable: Quality recording and/or spectral analysis of each individual noise producing component identified and eligible for noise reduction.
- Due Date:

Active Noise Reduction Research Milestone

- Description: This Milestone Represents Research into specific methods of Active Noise Reduction with specific reference to component candidates.
- Assigned to: Unknown
- Dependencies: Resources, General Acoustic Evaluation and Characterization Milestone, Component Acoustic Evaluation and Characterization Milestone
- Priority: Medium
- Deliverable: Specific Proposal for an Implementation of one or more method of Active Noise Cancellation for candidate components.
- Due Date:

Passive Noise Reduction Research Milestone

- Description: This Milestone Represents Research into specific methods of Passive Noise Reduction with specific reference to component candidates.
- Assigned to: Unknown
- Dependencies: Resources, General Acoustic Evaluation and Characterization Milestone, Component Acoustic Evaluation and Characterization Milestone
- Priority: Medium
- Deliverable: Specific Proposal for an Implementation of one or more method of Passive Noise Cancellation for candidate components.
- Due Date:

Noise Dampening Research Milestone

- Description: This Milestone Represents Research into specific methods of Active Noise Dampening with specific reference to component candidates.

- Assigned to: Unknown
- Dependencies: Resources, General Acoustic Evaluation and Characterization Milestone, Component Acoustic Evaluation and Characterization Milestone
- Priority: Medium
- Deliverable: Specific Proposal for an Implementation of one or more method of Noise Dampening for candidate components.
- Due Date:

Implementation Milestones

- Description: This Milestone set Represents Implementation work for each identified method of Noise Reduction proposed by previous three milestones.
- Assigned to: Unknown
- Dependencies: Active Noise Reduction Research Milestone, Passive Noise Reduction Research Milestone, Noise Dampening Research Milestone
- Priority: High
- Deliverable: Individual Implementations and testing records for identified methods of Noise Reduction
- Due Date:

Integration Milestones

- Description: This Milestone represents the Integration of Previously designed Implementations into a final and complete product design.
- Assigned to: Unknown
- Dependencies: Implementation Milestones
- Priority: High
- Deliverable: Unified Integration design and testing reports for entire Noise Reduced Paper Shredder.
- Due Date:

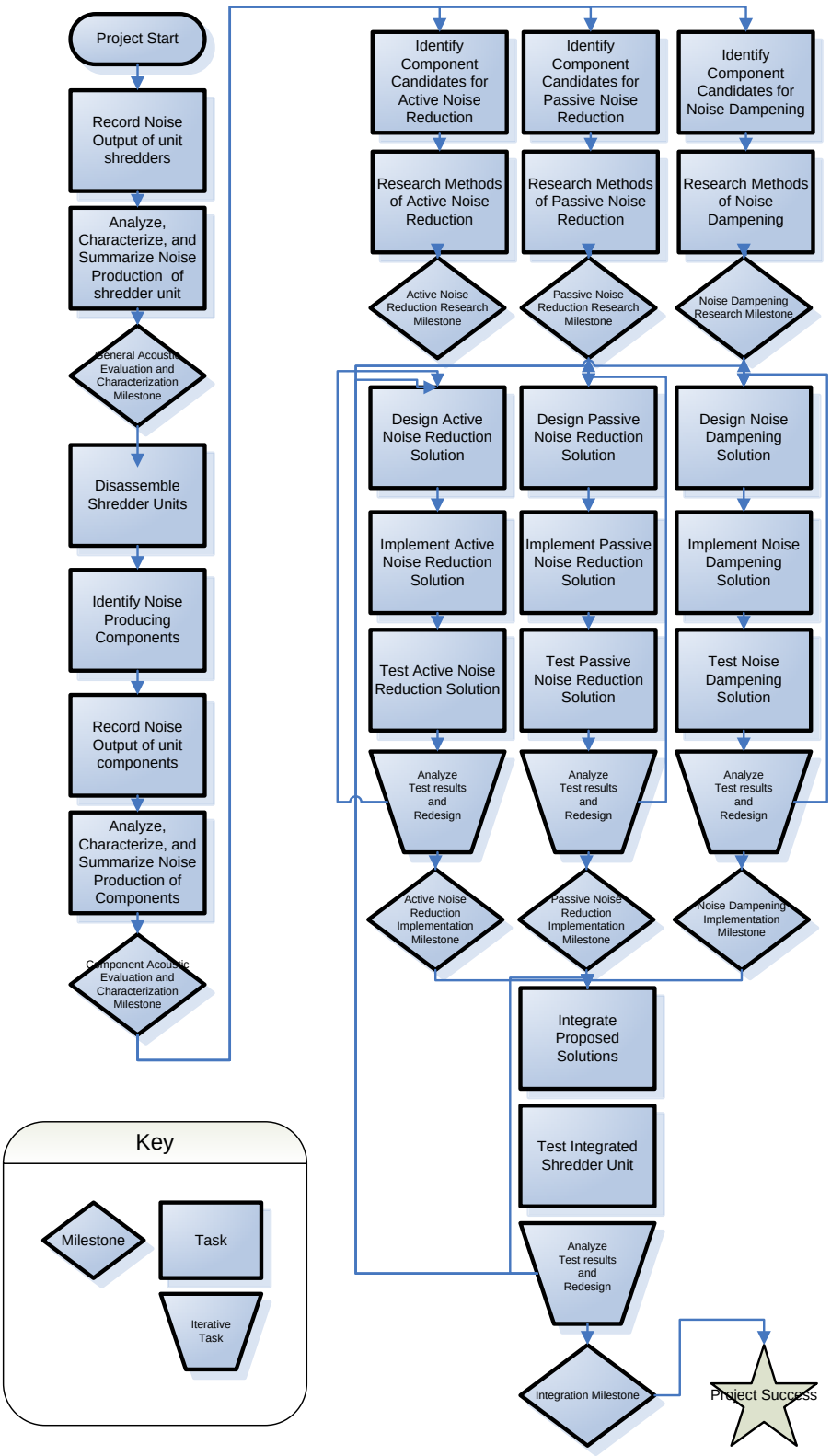
8. Determination of Success

Sound- Final Determination of Success will be entirely subject to the Staff and Leadership of the project sponsor, “The Manhattan Group.” Finally Deliverable should be in the form of a prototype Paper Shredder and/or Technical Design Documents outlining the proposed methods, implementation, and integration of noise reduction methods into one or more of the provided models of paper shredder. Final focus should be equally on specific implementation for currently provided models, as well as having an eye towards generic implementation in future models.

Safety - Final Determination of Success will be entirely subject to passing and exceeding all of the 2007 UL Standards for paper shredders.

Performance – Final Determination of Success will be a reliable paper shredder that can successfully shred the number of sheets it is marketed to shred and to not malfunction if overloaded. Ultimate goal is a reliable paper shredder as a low cost.

9. Project Outline and Dependency Tree


Project Start
Record Noise Output of unit shredders
Analyze, Characterize, and Summarize Noise Production of shredder unit
General Acoustic Evaluation and Characterization Milestone
Disassemble Shredder Units
Identify Noise Producing Components
Record Noise Output of unit components
Analyze, Characterize, and Summarize Noise Production of Components
Component Acoustic Evaluation and Characterization Milestone
Identify Component Candidates for Active Noise Reduction
Identify Component Candidates for Passive Noise Reduction
Identify Component Candidates for Noise Dampening
Research Methods of Active Noise Reduction
Research Methods of Passive Noise Reduction
Research Methods of Noise Dampening
Active Noise Reduction Research Milestone
Passive Noise Reduction Research Milestone
Noise Dampening Research Milestone
Design Active Noise Reduction Solution
Design Passive Noise Reduction Solution
Design Noise Dampening Solution
Implement Active Noise Reduction Solution
Implement Passive Noise Reduction Solution
Implement Noise Dampening Solution
Test Active Noise Reduction Solution
Test Passive Noise Reduction Solution
Test Noise Dampening Solution
Analyze Test results and Redesign
Analyze Test results and Redesign
Analyze Test results and Redesign
Active Noise Reduction Implementation Milestone
Passive Noise Reduction Implementation Milestone
Noise Dampening Implementation Milestone
Integrate Proposed Solutions
Test Integrated Shredder Unit
Analyze Test results and Redesign
Integration Milestone
Project Success
Key
Milestone
Task
Iterative Task