Improving and Increasing Safety of Palm Oil Harvesting Techniques

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Abstract

The palm harvester senior design project is dedicated to creating an effective, efficient, and economical solution to harvest palm fruits. For several years the methodologies used to harvest palm fruits have proven to be quite dangerous. This has caused a great need for more efficient methods to collect the palm fruit and maximize palm oil production. For the completion of this project, the team is following the six sigma methodology known as DMAIC (Define, Measure, Analyze, Improve, and Control).

Background Information

- **Major Countries**: Indonesia, Malaysia, Thailand, Nigeria, & Colombia
- **Region Characteristics** : Areas with high rainfall & tropical climates within 10° of the equator.
- **Oil Palm Plantations Size**: 10 hectares to 500 hectares.
- **Height of Oil Palm Trees** : Up to forty feet
- **Palm Fruit Bunch Size**: Up to 55 lbs.
- **Products with Palm Oil**: Cereal, toothpaste, Girl Scout cookies, etc.

Problem Statement

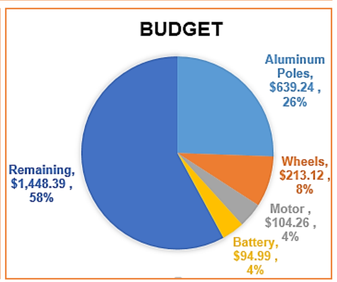
The goal of this project is to create a telescoping cutting mechanism that will both replace the current dangerous harvesting methods and improve the previous senior design mechanism.

Measurable Improvements

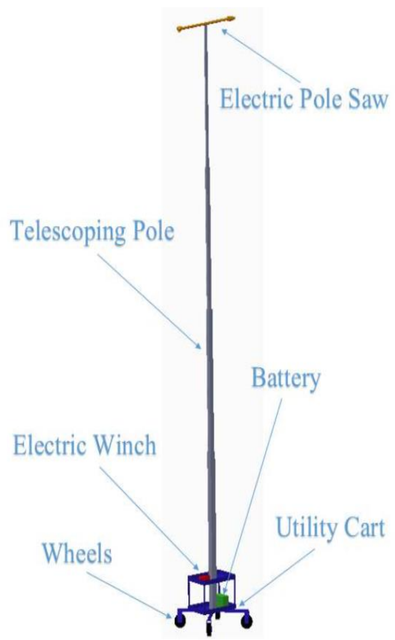
- Increase Ductility
  - Replacing the polyvinyl chloride (PVC) telescoping pole with aluminum
- Increase Mobility
  - Replacing the wheels with all-terrain, never flat tires
- Increase Stability
  - Lowering the center of gravity by mounting the poles to the bottom of the cart
- Decrease Manual Labor
  - Adding automation to the telescoping pole so that it may ascend and descend to and from the bunches of fruit

Resources

- HPMI
- ME Machine Shop
- Previous Year's Components
- Thomas Baker's Tools



Assembled Mechanism



Stress Analysis

Type:
Von Mises Stress Diagram

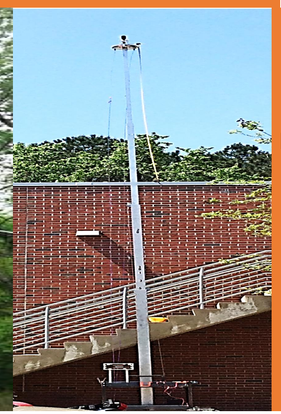
Applied Forces:
Weight forces of individual components
Wind force applied based on Malaysian statistical data

Results:
Largest stress distribution occurs on the cart
Maximum stress occurs on the brackets holding the wheel with a value of 303.9 MPa

Testing the Mechanism

Process	Old Mechanism (min:sec)	New Mechanism (min:sec)	Time Difference (min:sec)
Assembly	3:10	0:00	-3:10
Disassembly	1:40	0:00	-1:40
Rise to 25ft	0:40	0:16	-0:24
Lower from 25ft	0:40	0:12	-0:28
Total Saved Time			**5:42**

Deflection Analysis



Old Mechanism:
1,061 mm

New Mechanism:
11 mm

Difference:
1,050 mm

Considerations

- **Environment:** No exhaust gases expelled
- **Safety:** Hard hats worn at all times, telescoping height ≤ 35 ft (see reflective stickers), and operation only on level ground.
- **Ethics:** The product should be used for harvesting purposes only. The user should have proper training and knowledge of the device.

Conclusions

- The poles were replaced and automation was achieved
- The center of gravity was lowered, increasing cart stability
- Due to restrictions at the Engineering School the team was unable cut branches

Future Recommendations

- Working camera mechanism
- Fruit catching system
- Cutting alignment mechanism

References

[1]Web.1.Apr.2015.http://eng.fsu.edu/cms/multimedia_services/image_archive.html
[2] "Palm Oil: Productive and Versatile." *WWF* -. Web. 30 Mar. 2015
[3] "Palm-harvester." *Palm-harvester*. Web. 1 Apr. 2015. <http://david1boswell.wix.com/palm-harvester#!deliverables/cubz>.