Concept Generation and Selection

Team 14
Turbine Blade Handling with TECT Power

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Introduction

TECT Power

- A turbine part manufacturing facility
- Currently process a variety of turbine blades
- Located in Thomasville, Georgia
- Objective – Come up with a design that will remove manual lifting from their processing of a 68K blade.

Project Focus

- Safety
- Modify current cart
- Orientation and 3D position of the blade
- Load and unload
- Machine friendly
- Efficient
- Cost affective

Existing Apparatus

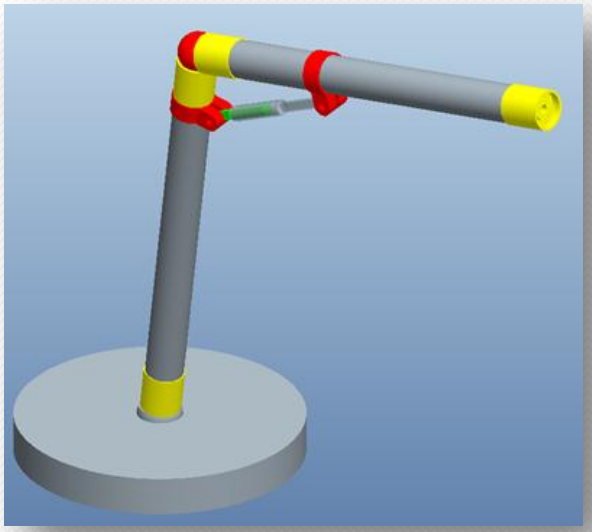
Previous Team

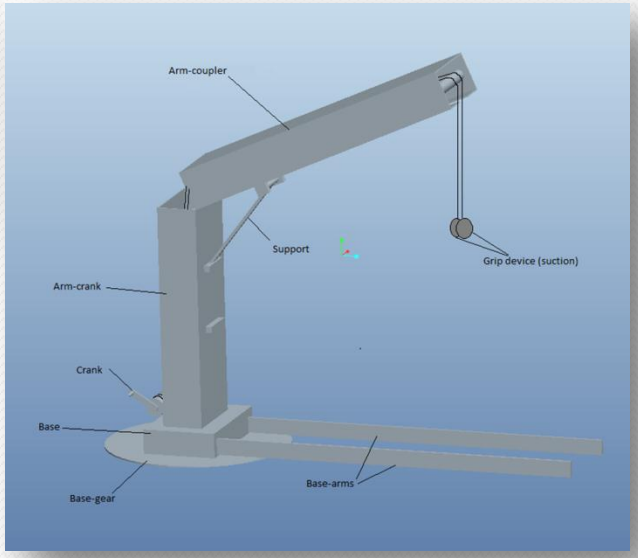
- Cart design
- Transport from storage to machine 1
- Orientated horizontally
- Many machines

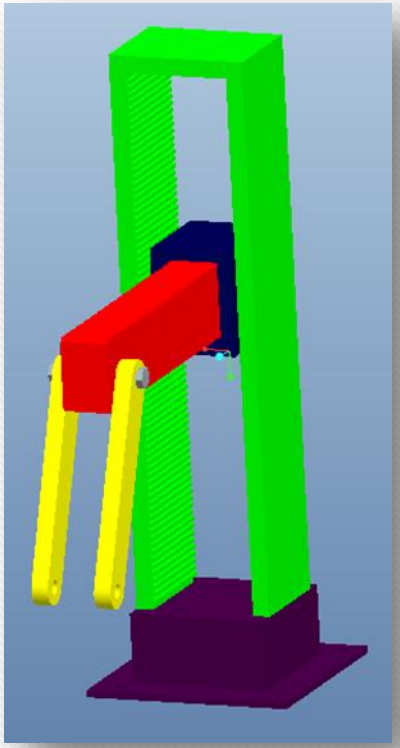
Modifications Necessary

- Cart stability
- Additional mass to the base of the cart
- Blade orientation
- Rigid grip of blade
- Cart maneuverability
- Altercation of current tray carrier

Part 1 – Arm Apparatus

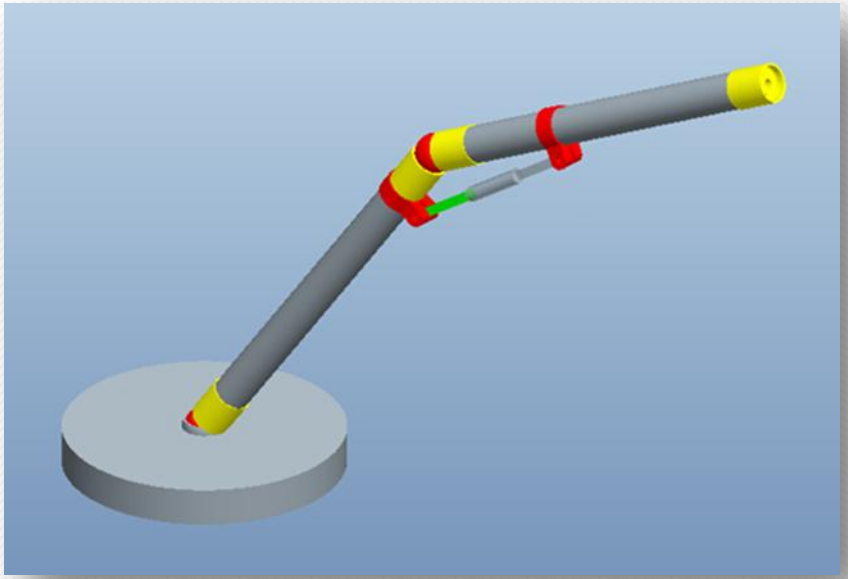






Design 1 – Ball-Joint Arm

- Autonomous assembly lines
- Two rigid arms connected by a ball joint
- Hydraulic damper
- Spring
- Power screw
- Allows for a large degree of freedom
- Reach below itself and extend outwards



Design 1 – Ball-Joint Arm

Pros

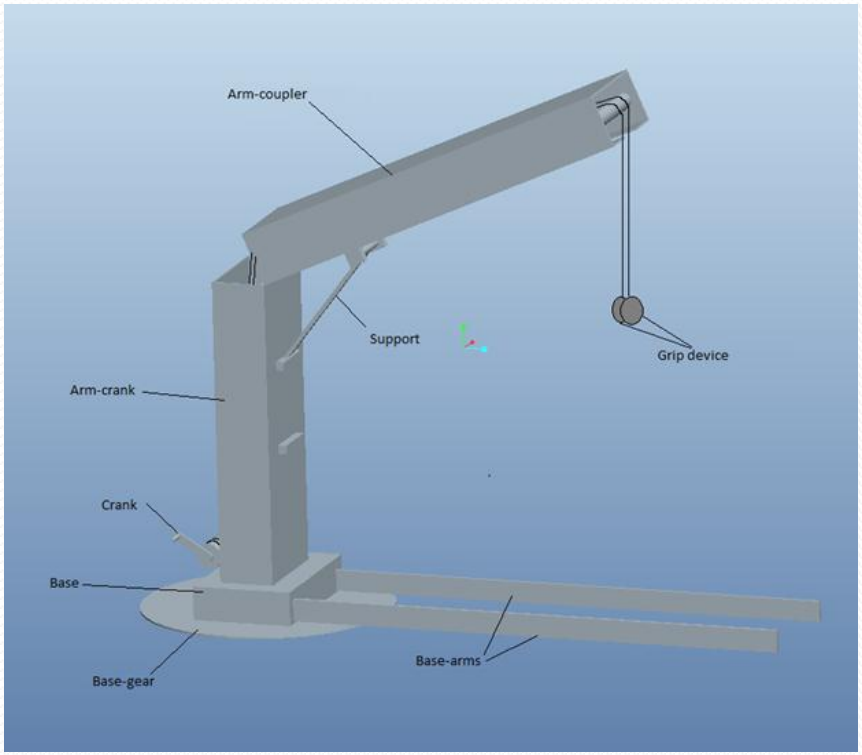
- Capable of large reach
- Capable of reaching below itself
- Natural design (human like-arm)
- Easily Adjustable
- Compactable

Cons

- Potentially expensive components
- Low durability
- May not reach certain positions
- May be difficult to calibrate
- Replacement of parts

Design 2 – Pulley System Crane

- Mechanical advantage
- Pulley system
- Arm-coupler angle
- Rotation about the vertical axis via base-gear
- Individual control of each grip with crank



Design 2 – Pulley System Crane

Pros

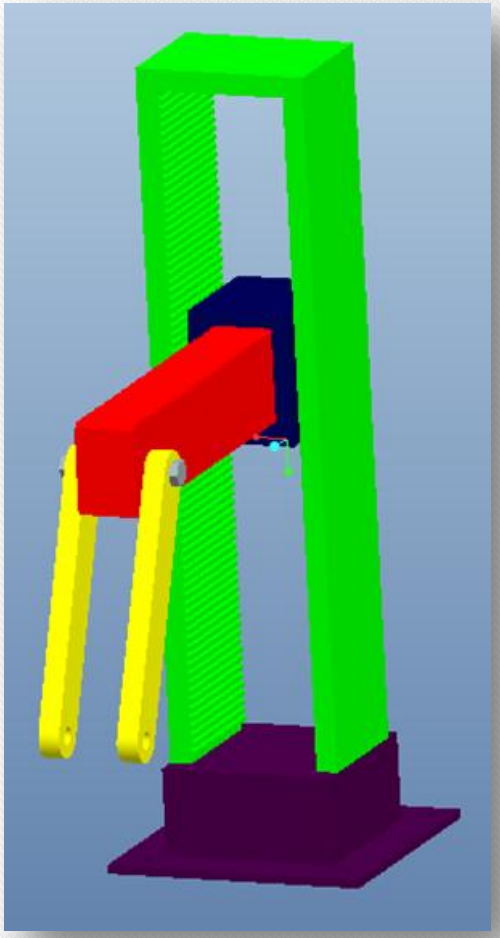
- Mechanical lifting mechanism-Cost
- Durable
- 4 degrees of Freedom
- Multiple blade orientations can be achieved
- Can lift blades from floor

Cons

- Suction may be difficult to achieve on an oiled surface
- Fairly slow lifting process
- Possibly difficult self operation

Design 3 – Threaded Track

- Equipped with an elevator like structure
- Locking system will be implemented to allow the blades to rotate
- Properly geared to provide user/motor with ease



Design 3 – Threaded Track

Pros

- Ability to move the blades vertically and horizontally over any objects
- Structural Strength
- Purely mechanical

Cons

- Not super compactable
- May be difficult to maneuver blades into machines
- Maintenance

Part 2 – Grip Apparatus

Form-Fitted

- Interchangeable
- Dynamic
  - Vacuumed sand
  - Malleable material

Suction Cups

- Inexpensive
- Effective at 45 lbs.
- Cons
  - Surface
  - Oil

Decision Matrix

Arm Concept	Cost	Maneuverability	Effectiveness	Efficiency	Safety	Durability	Maintenance	Practicality	Compactability	Machinability	Total Score
1	3	4	3	3	4	1	3	2	4	3	**30**
2	5	3	3	2	4	2	3	2	3	4	**31**
3	3	2	2	2	3	4	2	3	1	2	**26**

Decision Outcome

- Design 2 Chosen
  - Cheap
    - Machine most parts
  - Simple design
    - Expandable
  - User-friendly
- Grips will be decided by remaining budget and modifications made to the arm design

References

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