Team Elevate: EZ Lifter

CONCEPT GENERATION

Objective
- Design for Assembly
- Strength
- Weight

Concept Generation
- Force Required to Lift
- Multiple Dimensions
- Size when collapsed
- Attaches to rack
- Lift and Secure in one motion
- Very versatile
- Can be used for any shape and size
- Can only be used to lift one object
- Convert lift force to moment
- Kayak can be strapped
- Very sturdy and sits flat on roof
- Can also be used on vehicle bigger than SUV
- One Person will be able to use it
- Telescopes down to knee height
- Kayak Secured from ground
- No complicated device
- Very safe during travel

Customer Requirement
- Lifts from ground
- Assistance to lift
- Collapsible
- Easy to maneuver
- Adjustable
- Weight and Size
- Weather
- Height of vehicle
- Stock roof racks
- Height of device on car
- Cost <$200
- Very sturdy and sits flat
- No complicated device
- Easy to maneuver
- Adjustable
- Weight and Size

Constraints
- Weather
- Height of vehicle
- Stock roof racks
- Height of device on car
- Cost <$200

Structure

Operation of Product
- Unhook security pin
- Slide mechanism out to the side
- Extend telescoping arms
- Secure kayak to the arms
- Move the telescoping arms back
- Slide back rack with kayak
- Hook security pin

Key Features
- Provide assistance in lifting kayak from knee position, collapsible for storage and secures on roof racks
- Weight and Size
- Easy to maneuver
- Adjustable
- Weather
- Height of vehicle
- Stock roof racks
- Height of device on car
- Cost <$200

Customer Requirement Satisfied
- Collapsible System
- Light Weight
- Less force

Tradeoffs
- Cost < $200
- Height of device on car
- Stock roof racks
- Height of vehicle
- Weight and Size

DESIGN

We have created two prototypes with the purpose of testing two different aspects of our final design. The testing will be for the two most important parts of our design.

First, we have constructed a scaled down spring-damper telescoping arm to test the capability to assist in lift force required.

Second, we have constructed a larger scale lever arm system to simulate the motion of lifting the kayak onto the roof of a truck and help us determine the force required to lift.

TEST RESULTS AND FUTURE WORK

Spring-Damper Testing
- Tested multiple springs with different spring constants
- Timed how long it takes for arms to telescope and deploy
- Used test results to identify best damper-spring combination

Effect of Spring Constant
- Users asked to deploy system and to store it
- Time taken to store and deploy system recorded

Future Work
- Create DOE for testing springs, dampers and gear radii
- Mechanism to tighten up system when in stored position
- Create full sized model and test with kayaks

Customer Requirement
- Lift from ground
- Assistance to lift
- Collapsible
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- Weight and Size

Constraints
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- Height of vehicle
- Stock roof racks
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- Cost <$200

Prototype and Process Design and Development

ENME472 - Integrated Product and Process Design and Development

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