International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 04 | Apr -2017 www.irjet.net p-ISSN: 2395-0072

# Automated storage system for Kayak

**Renuka Patil[1], D. S. S. Sudhakar[2]**

*[1]Fr. Conceicao Rodrigues College of Engineering,*
*Mumbai University,India*
*[2]Associate Professor,HOD, Department of Production Engineering*
*Fr. Conceicao Rodrigues College of Engineering,*
*Mumbai University,India*

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**Abstract -** *New products are always required to compete in the existing market. Invention of new product is done regularly. New systems are developed on daily basis to by the companies to stand the ever growing market. Today in market there are many products which support the storage of the kayaks. A new kayak storage system is designed. The design arrangement has been made with the help of pulley to reduce effort. Further, the gear and motor arrangement has been used to reduce human efforts.*

***Key Words***: Kayak Storage, Motor operates, Remote controlled

## 1. INTRODUCTION

In today's world, new products are replacing existing products on a regular basis and at very fast rate. The rate at which new products are appearing on the market is growing at an exponential rate. The factors responsible for this can be:

- Increasing customer demands
- product differentiation
- Support continued growth for the manufacturer
- Capitalize on technological breakthroughs
- Response to changing population segments

The commercial accomplishment of the firms depends on their capability to recognise the needs of the customers and to meet their problems by creating the products which satisfy their needs.

## 2. LITERATURE REVIEW OF THE EXISTING DESIGNS FOR TYPES OF KAYAK STORAGE SYSTEM.

A kayak is a small, narrow boat which is propelled by means of a double-bladed paddle. The word kayak originates from the Greenlandic language, where it is the word qajaq (pronounced [qajaq]). In the UK the term canoe is often used when referring to a kayak. Some modern boats vary considerably from a traditional design but still claim the title "kayak".

### 2.1. Length of Kayak:

Kayaks that are built to cover longer distances such as touring and sea kayaks are longer, generally 16 to 19 feet (4.9 to 5.8 m). With touring kayaks the keel is generally more defined (helping the kayaker track in a straight line.) Whitewater kayaks, which generally depend upon river current for their forward motion, are short, to maximize maneuverability. These kayaks rarely exceed 8 feet (2.4 m) in length, and play boats may be only 5–6 feet (1.5–1.8 m) long. Recreational kayak designers try to provide more stability at the price of reduced speed, and compromise between tracking and maneuverability, ranging from 9–14 feet (2.7–4.3 m)

### 2.2 Width of Kayak:

Sea kayaks, designed for open water and rough conditions, are generally narrower 22–25 inches (56–64 cm) and have more secondary stability than recreational kayaks, which are wider 26–30 inches (66–76 cm), have a flatter hull shape, and more primary stability.

Table 1: Physical aspects of kayak

| Length | Width | Volume | Weight range |
|---|---|---|---|
| 231 cm | 60 cm | 211 L | 35–65 kg |
| 236 cm | 61 cm | 232 L | 40–80 kg |
| 249 cm | 65 cm | 267 L | 65–105 kg |
| 270 cm | 68 cm | 300 L | 85–125 kg |

### 2.3 Storage of kayak:

Improper storage can quickly degrade hull shape, color and UV-protection. Kayaks should be stored on edge, upside down, standing, or hanging horizontally. When hanging a boat, run straps around the boat near the cockpit (the strongest part of the boat). Hanging your kayak in slings or webbing is ideal and will prolong the life of the boat. A word of caution - using the scupper holes may cause distortion and hanging from the toggle handles may put undue strain on them. Storing the boat bottom side down may also cause distortion

At present, the kayak storage products available in market can be divided in three categories:

Wall Mounted

Roof mounted (hanging)

Simple Stands

As per the survey and observation made, it was decided to design a roof mounted kayak storage system. This storage system will consist of pulleys, ropes, motor, which will be operated with the help of remote. Pulley system makes loading and unloading items on the vehicle's roof simple and less strenuous. Kayak can be stored overhead and out of the way in the garage. Smooth pulleys and latches make lifting even the heavier kayaks super easy.

## 3. DESIGN:

### 3.1 Design concept:

The 5-pulley arrangement has been done in such a manner so that the effort required at the end is reduced. The rope drum arrangement has been done along with the motor and the gearbox. Rope drum is connected to the motor and gearbox. 1500 RPM motor is used to drive the worm gear box.

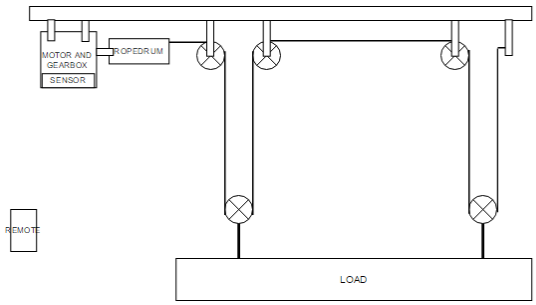


Fig.1 : Block diagram of the mechanism

The worm gearbox is used. Worm gear drive is commonly used to obtain higher velocity ratio when compared with other forms of gearing Worm and worm gear system can provide very high-speed reduction usually from 30 to 300). Often this drive is self-locking, which means rotation of worm gear will not cause worm to rotate. i.e. reverse rotation is prohibited, not allowing the kayak to lower down. This doesn't allow any accidents.

The motor is operated with IR remote control. For the proper functioning of the remote, the sensors need to be in line of sight. When the signal is sent from the remote, the photo sensor attached to motor picks up the signal and turns the relay on/off. Accordingly, motor is turned on/off.

As the motor is turned on, the rope drum rotates and thus the kayak rises.

3.2 Steps to calculate the output required at the motor:

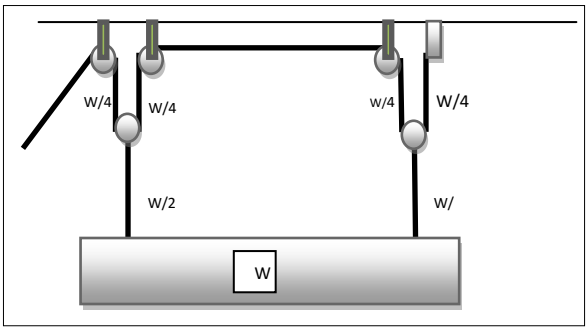


Fig.1: Block diagram for Mechanical Advantage

Calculation

Referring above figure,

Due to the pulleys the effort required will be reduced.

1) Calculating the mechanical advantage:

Mechanical advantage= Load/Effort;

Effort = Weight to be lifted /no. of pulleys

= W/4 (W=weight of kayak)

From the above the effort required is ¼ th of the weight of kayak.

The mechanical advantage=velocity ratio = 4.

2) Assume the velocity of rise for kayak =20rpm

3) A rope drum.

Diameter of rope drum (assumption) =d=10cm (0.1m)

Circumference $= \pi * d$

= πx0.1 = 0.314m

4) Since V.R. is 4,

The velocity required at the end of gearbox (nominal output) = r

= 4x20 = 80rpm

Taking 1500rpm motor,

$$\text{Ratio} = \frac{1500}{80} = 18.15$$

Thus, ratio to be considered = 20:1

The reduction ratio for gearbox is 20:1.

5) Torque required

$$\tau = 0.5 * 15 = 7.5 \text{ kgm}$$

6) Power required (hP)

$$= \frac{\tau * r}{5250} = 1.1264hP$$

Thus, the output power to the motor to be considered = 1.5hP.

Hence, the 1500rpm motor with 1.5hP output is used.

### 3.3 Design of rope drum:

Length of rope= $\frac{A^2(B^2-C^2)}{15.3(Rope\ Diameter^2)}$

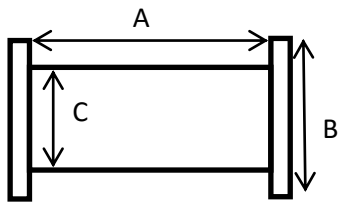


Fig.2: Block diagram for Ropedrum

C= 3.94inch

B=5.9inch

Rope diameter= 0.25 inch

Length of rope considered= 8feet =96inch

Therefore,

A = (8x15.3x0.25x12)/ (5.92-3.92)

= 1.58

= 18.96 inch

Hence the length of ropedrum is 18.6 inch ~ 19 inch

### 3.4 Selection of rope

Since the weight to be lifted is not much, nylon rope can be used is system for lifting purpose. Following are benefits of nylon rope

Superior strength and remarkable stretching capabilities.

Lower resistance to abrasion

Positive points: strong, smooth, UV resistant, Chemical resistant.

The approximate SWL of a fiber rope can be found from the formula: SWL (kg) = F × D2

Where:

D is diameter of rope in mm

F is a factor of safety

SWL is in kilograms.

Considering the SWL = 80kgs,F= 3

80= 3xD2

D= 5.16

Hence rope with diameter of 5mm is taken.

### 3.5 Selection of webbing sling

The Polyester Webbing slings offer following advantages over conventional Slings:

Does not Damage Smooth polished surface.

Does not Corrode unlink Conventional Metal slings.

Light in weight compared to wire / chains.

Has easily identifiable International color code, with safe working load printed on slings.

Safety factor 6:1 and 7:1.

Wears evenly as the sling is used along circumference length.

Since there is no metal to metal contact hence there is no danger of sparks

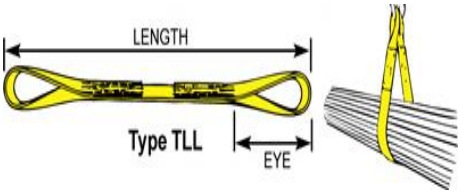


Fig.3: Webbing / Sling

Twisted Eye (EE) slings are made with a flat loop eye on each end with a loop eye opening not on the same plane as the sling body. This type of sling is sometimes called: twisted eye & eye. It is easy to hang/hook up the flat eye sling easily as compared to other type of slings.

## 4. INSTRUCTIONS FOR INSTALLATION AND STORAGE:

### 4.1. Installation

Fix the pulley to the ceiling with the help of nuts and bolts. Run the rope through the pulleys as shown in block diagram. Make sure the system is balanced. Now fix one end of the webbing sling in the hook. Secure the kayak with the help sling and fix another end in the hook. By this, the kayak is placed securely in the strap. Now, with the help of remote control, pull the kayak up. This is designed for ceilings up to 12 feet tall. The system also works with items like bicycles, ladders, and cargo boxes.

Most canoe hulls will deform or bend over time if exposed to uneven weight distribution. Plastic hulls are the most susceptible to damage, but fiberglass and wood-hulled boats can also fall victim over time. To avoid this, polyester webbing sling is used that fits the kayak properly.

Correct way in which kayak is to be stored:

Spread out the weight of the canoe over its entire length whenever stored.

Try to position the "slings" about 25% in from the ends of the canoe

Do not store canoe upside down on the ground

Do not stand it up on one end.

Do not hang it from its grab handles or thwarts.

## 5. ADVANTAGES:

Below are some of the advantages of the automated kayak system:

Mounts easily to ceiling studs or rafters

Human efforts are reduced

Remote control helps to run the system from the distance.

Worm gear box does not cause the reverse slide of kayak. The kayak is locked at the

Load straps adjust to fit everything from wide cargo boxes to skinny sea kayaks.

## 6. FUTURE SCOPE

In today's world, everyone is going digital. So in similar lines, an app can be developed which can be used to operate the motor.

**References:**

1 "Buying a canoe or kayak". gocanoeing.org. Retrieved 8 September 2014.

2 Jump up^ "British Canoeing - About canoeing". britishcanoeing.or.uk. Retrieved 19 September 2016.

3 https://en.wikipedia.org/wiki/Kayak

4 http://www.chinakayaksports.com/news/the-design-principles-of-kayak-3697.html