



## **EFFICIENT LAKE GARBAGE COLLECTOR BY USING PEDAL OPERATED BOAT**

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**Abstract**—The most sacred river in the world and the national river of India “Ganga River.” Ganga is the soul of India and is Holly River in India. If we look at current status of our national river it is very shocking we dump about 29 crore litres of sewage in Ganga which is loaded with pollutants, toxins.<sup>[9]</sup> We also dump tones of municipal solid waste. The government Of India takes charge to clean rivers Ahmadabad, Varanasi, etc. All of us know about the Ganga Abhiyan. Similarly, The villages in all state of India which joint with small & big lake and maximum villages does not use the water of lake for farming as well as drinking and daily uses due to the maximum amount of garbage present in the lake water by taking this into consideration. Our main motive is to clean the lake water for that purpose we are making efficient lake garbage collector by using pedal operated boat. In this we are using pedal operated boat with the conveyor attached to it for collecting garbage from the lake.

**Keywords:** Pedal Boat, Pedal, Propeller, Conveyor, Collector.

### **I. INTRODUCTION**

The most sacred river in the world and the national river of India “Ganga River.” Ganga is the soul of India and is Holly River in India. If we look at current status of our national river it is very shocking we dump about 29 crore litres of sewage in Ganga which is loaded with pollutants, toxins.<sup>[9]</sup> We also dump tones of municipal solid waste. The government Of India takes charge to clean rivers Ahmadabad, Varanasi, etc. All of us know about the Ganga Abhiyan. Similarly, The villages in all state of India which joint with small & big lake and maximum villages does not use the water of lake for farming as well as drinking and daily uses due to the maximum amount of garbage present in the lake water by taking this into consideration. Our main motive is to clean the lake water for that purpose we are making efficient lake garbage collector by using pedal operated boat. In this we are using pedal operated boat with the conveyor attached to it for collecting garbage from the lake.

Several companies offer equipment to garbage out of river lakes and harbours .The water surface trash collection boat can work in river or lake, it can collect the floating garbage and some other equipment for weed cutting, it harvest the aquatic weed from lake. This is really a good solution for the aquatic weed management. Many says they could build larger dustcarts for the sea and ocean, if there was a demand of them those seen here may not be ideal for collection on large scale but it is food for thought.<sup>[11]</sup>We are making the boat which is operated by pedal and clean the waste present in the lake. In this boat the conveyor collect the waste present in lake and then collect it in box like structure present in lower side of the boat. We are trying to collect the waste like polythene, food material, and the waste occurs due to religious festival.

A pedal operated boat that uses a shaft to drive a propeller.

- A pedal boat comprising two pedal, two propellers, attached by the shaft.
- The pedal powered boat further comprising control assembly.
- In this boat we attached conveyor system operating by the same pedal, for cleaning the garbage in the lake.

## II. PROBLEM STATEMENT

India is a blessed country when water sources come into question which is available in the form of numerous river sand lakes. There are several sources of water pollution, Domestic wastes that we throw into rivers add to pollution levels. As population grows, the size of towns and cities also grows. With that the amount of domestic wastes that we throw into river increases.<sup>[1]</sup> As we see India's the most holy river "Ganga river" we found many amount of garbage in the river, likewise small and big lakes which is nearer to the villages, in which we found the garbage in large amount because of which we can not use the lake water for our daily uses.

As the garbage is present in the river and lake, the water of river and lake is get polluted. This polluted water affect the human lives if we use this contaminated water for drinking, the resident suffer from epidermal, gastrointestinal, neurological disorders and cardiac ailments. There is no small and fuel efficient devices for collecting the garbage from river and lakes.<sup>[1]</sup>

### 2.1 OBJECTIVE:

- ▶ To clean the garbage present in small and big lake.
- ▶ To minimise the use of fuel operated garbage collector.
- ▶ To tackle the problems regarding wastage, food material, plastics present in the lake.
- ▶ To clean the polluted water due to which save the aquatic animal.
- ▶ To minimize the human efforts which required to clean the lake.

### 2.2 METHODOLOGY:

In this system we are using the boat which is pedal operated and we attached the belt conveyor for collecting the garbage present in the small and big lake. With the help of this conveyor we can collect the garbage like plastic bags, plastic bottles, beverage cans, food wrappers, paper bags, straws, (marine debris) etc. We can use this pedal operated boat beside the slum areas where we can find lakes, rivers or dam an also because of which this slum area use this water for drinking purposes due to which there health issue will not get affected. With this methodology also the source of fuel like diesel, petrol can be saved.

## III. LITERATURE REVIEW

Mark Knapp wrote in his patent that a pedal powered boat that uses a flexible shaft to drive a propeller. By using a flexible shaft, the user seat can be placed lower in the vessel, thereby increasing stability. The device also uses a pair of foot pegs and a ratcheted straight driver, which eliminates standard pedals, with there sweeping circular motion. This straight drive not only increases the efficiency of the lake power, it also converts the rotary action of the pedals to a linear motion that reduces the amount of space required to operate the unit. Thus, the driver unit can be placed under a seat so that it does not excessively intrude into the space of the boat.

This invention relates to pedal powered boats and particularly pedal powered boats using a flexible drive shaft. Pedal powered boats have been used for many years in many different situations. Many lakes or ponds in parks have small catamaran-type boats that users pedal leisurely around the pond. Although these boats are fun, they are not very practical, except as amusement. Standard rowboats can be provided With a pedal-powered motor. These boats are used in areas. Where electric or gas engines are prohibited or Where these types of propulsion are too noisy. Pedal power is silent. Moreover, it is also highly controllable at low speeds, such as those used during fishing. The operator can stop the boat quickly by not pedalling. Moreover, the operator can move a fair distance by pedalling, While still having full use of his or her hands.<sup>[10]</sup>

The British company Water Witch offers two boats that are especially designed to clean up marine debris. The Buddy Catamaran is a litter retrieval and waterway maintenance boat for marinas, harbours and inland waterways. The Buddy is built from aluminium and designed for ease of

operation and low cost of ownership, this road-transportable vessel features a removable basket, which can be lifted and tipped directly into a skip or shore side receptacle for disposal. The boat can filter a water surface of 92 x 92 metres per hour. The filter system can be adjusted to collect different sizes of flotsam. The Buddy is extremely adaptable for a huge range of applications ranging from fast-response to pollution control needs, to diving and maintenance support. This vessel really earns her keep! The design incorporates a variety of 'pods' that sit between the twin hulls enabling many tasks to be undertaken. The pod system allows heavy items to be loaded directly onto the quayside and lifted onto the vessel via a crane with no need to manhandle the equipment to the water. The Buddy's principle feature is the collection of litter, debris and floating weed from the water surface into a removable basket, which can be lifted and tipped directly into a skip or shore side receptacle for disposal. The Cargo Pod is designed specifically for transporting up to 1 tonne of cargo and equipment for use on or off the water. The pod can be craned in and out of the Buddy empty or full, allowing the operator to keep a range of pre-configured pods on hand for jobs such as mobile pump-out, wash down and waste disposal. The Water Witch workboat could be compared to a floating bulldozer and features a powerful front end loader which can lift up to 1000 kg and reach to 3.65m below the waterline. About 100 of them are in use worldwide. A quick-release system ensures a range of loader attachments can be easily fitted in seconds. Attachments available include dredge buckets, log grapples, weed cutters/rippers, access platforms, cranes and more. Modular skip barges allow recovered debris and waste to be stored and transported using transfer skips employed by waste removal contractors worldwide. Each barge features quick-connect couplings to allow additional units to be connected to suit capacity requirements. Jackie Caddick, director of Water Witch, recently said in an interview that they could easily build much larger versions of their dustcarts if the money is available (source, in Dutch). Much larger garbage barges already exist.

Marina Cleaners are available in fresh water or salt water versions and feature an articulating vertical wing capture system that delivers debris to the front pick-up conveyor. Large and small objects are easily retrievable and roll back is prevented with cross cleats. The Marina Cleaners (MCs) are built with a low profile configuration for navigation under lower bridges.

All standard Marina Cleaners are featured and equipped with the A complete Hydraulic System for all skimming, load handling, and propulsion functions, with variable speed control at the operator's finger tips. A Air Cooled Diesel Hydraulic Power Unit, placed into a noise proofed, lockable engine room. Lockable Hydraulic Oil Tank, Filtration, Hydraulic Oil Cooler, Hydraulic Directional Valves. Stainless Steel Hydraulic Cylinder Rods. Operator's platform with a seat and console with engine controls monitoring system including warning lights, tachometer and hour meter, and hydraulic controls with pressure gauge. Conveyor Belt System made of heavy duty Stainless Steel supported by UHMD plastic tracks and interchangeable floors. Articulated Skimmer Wings Front Conveyor with adjustable depth setting and cleats mounted to belts. Storage Conveyor with load indexing and height adjustable discharge Twin Pontoon Steel Hull "hydro-dynamically" shaped, including multiple compartments, inner ribbing, tie and lift cleats, drains and vents, anti-skid deck, bottom skids, rub rails, gunnels. Two independent, bi-directional Hydraulic Propulsion Units with variable speed controls, bronze propellers, stainless steel shafts, drop arms, and hydraulic connections, as well as tunnel guards, and power tilt. Railings and Guards Stainless Steel Fasteners [12]

## IV. CONSTRUCTION

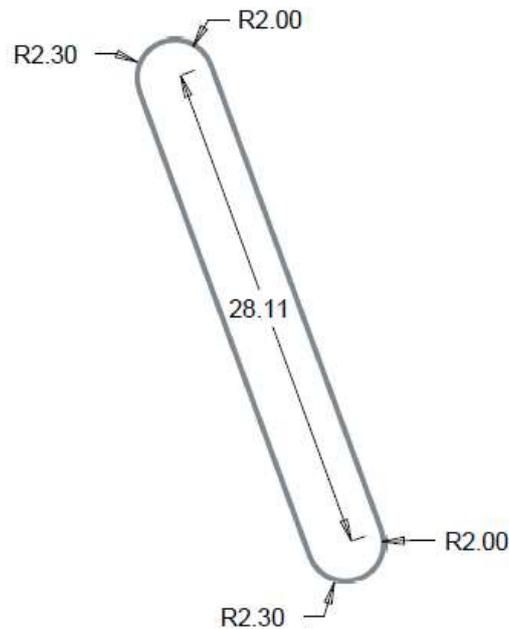
### 4.1 CONVEYOR:

In the process or manufacturing industry, raw materials and products need to be transported from one manufacturing stage to another. Material handling equipment are designed such that they facilitate easy, cheap, fast and safe loading and unloading with least human interference. For instance, belt

conveyor system can be employed for easy handling of materials beyond human capacity in terms of weight and height.<sup>[3]</sup>

Light fabric conveyor belts are, according to the International Standard ISO 21183-1 “Light conveyor belts. Principal characteristics and applications”, predominantly used for collecting the garbage in the box type structure in the boat. Fabric conveyor belts are made of various layers, where the tensile strength is provided by synthetic fabric plies. In light fabric conveyor belts, the fabric is usually made of polyester, in some cases of polyamide or aramide.<sup>[2]</sup>





*Fig 4.1.1 Conveyor*

#### **4.2 PROPELLER:**

Propeller is a type of fan that transmits power by converting rotational motion into thrust. A propeller works by accelerating water (or air) backwards. This backwards thrust must be balanced by an opposite force facing forwards and this is what drives the boat along.<sup>[5]</sup> Before we can begin to examine the propeller selection process in detail, we have to define clearly the propellers we will be choosing: How are they shaped? What are the difference and similarities between them? What types of propellers do we have to choose from, and which types are best suited for which service?<sup>[4]</sup>

#### **PARTS OF THE PROPELLER**

**Hub:** The hub or boss of a propeller is the solid centre disc, bored for the propeller shaft, to which the propeller blades are attached since the hub generates no drive, the ideal would be to eliminate it. As a practical matter, though the hub can seldom be much less than 14 percent of diameter in order for it to have sufficient strength.

**Keyway:** Most propeller shafts transmit the torque from shaft to propeller through a key. The key is a long, slender rectangle of metal along the shaft that fits into a slot or keyway milled (cut away) into the interior at the hub.

**Blades:** The propeller blades are the spoon shaped that project out from the hub. It is the action of the blades that drives a boat through the water.<sup>[4]</sup>

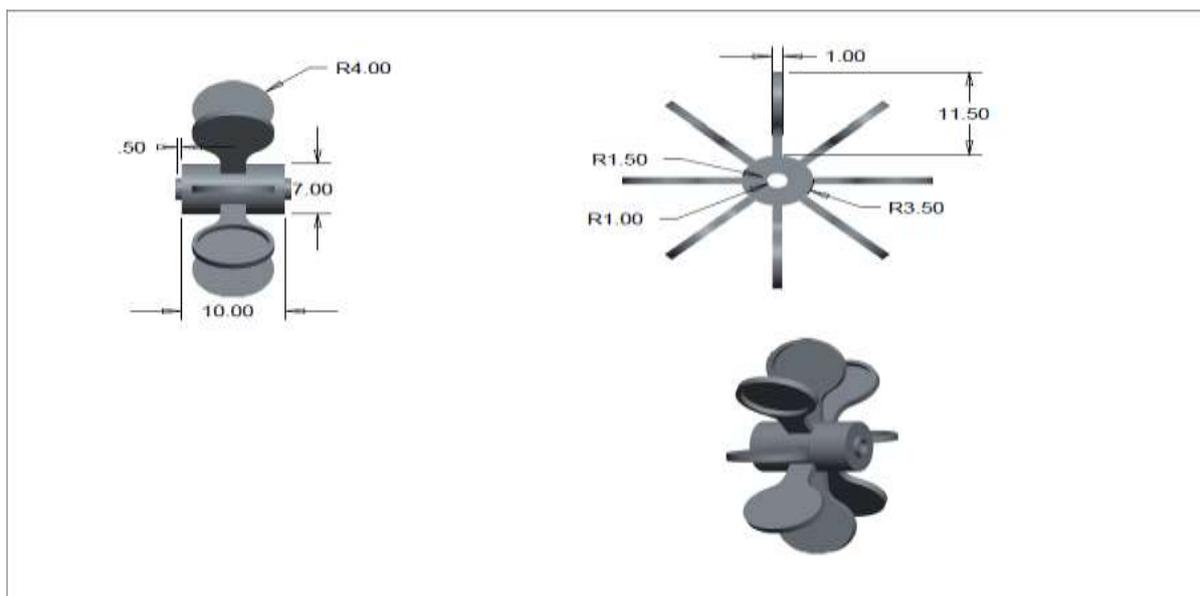


Fig.4.2.1 Propeller

### THREE BASIC CHARACTERISTICS

Diameter, revolutions per minute and pitch are the three most significant factor affecting propeller performance and efficiency. Although many other variables need to be considered, the vast majority of calculations for selecting a suitable propeller revolve around these three characteristics

**Diameter:**The obvious characteristic of any propeller is its diameter (D). This is simply the distance across the circle swept by the extreme tips of the propeller blades. Diameter is the single most critical factor in determining the amount of power that a propeller absorbs and transmits. It is thus the most important single factor in determining the amount of thrust delivered.

**Revolutions per minute:** Revolutions per minute (RPM or N) is the number of full turns or rotations that a propeller makes in a single minute. Since the propeller rotate at the same speed as the propeller shaft, this is often called shaft RPM or tail-shaft RPM.

**Pitch:** Controllable-pitch propeller allows the operator to changes the pitch of the propeller blades at will while underway. Controllable-pitch propellers offer significant advantages in economy for operation for vessels that operate under varying condition of load. Pitch converts the torque of the propeller shaft to thrust by deflecting or accelerating water astern. The formula describing this is Newton's Second Law: force (or thrust) equals mass times acceleration or  $F=M A$ . In this light, a propeller drives a vessel forward exactly as a jet engine or rocket motor propels a plane or missile. The force is directly proportional to the mass or weight of water moved astern times the acceleration of that mass.<sup>[4]</sup>

### 4.3 SEAT:

As per the ergonomics consideration the seat design in such a way that it provide more comfort to the human being those who operate these boat in working areas. as we know ergonomics is an applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely. As per ergonomics standardThe data ofIndian human being to arrange the seating challenge of designing for the human body is that it comes in so many different sizes andshapes. As a result, a design that may be comfortable for one person can be inappropriate forothers. Obviously clothes and shoes come in different sizes to accommodate these differences.Proper fit becomes much more important when it relates to a product that a person will bephysically interacting with for hours at a time.

The standards are compiled by experts in the fields of human factors and ergonomics in partnership with the leading manufacturers of chairs and office systems. These standards represent the combined cumulative knowledge of these experts for the purpose of improving the accommodation of people, and reducing the risks of injury in the office environment.

The chair standards are intended as a reference and a starting point for design. They are updated periodically to reflect accepted research and best practices. The standards provide design guidance to meet minimum requirements in addition to adjustability ranges to increase the percentage of the population accommodated.

The standards propose dimensional specifications based on body dimensions of the 5th percentile (small) female to the 95th percentile (large) male (refer below). This range covers only 95% of the population and is intended to meet the MINIMUM requirements of users. Haworth's ergonomic seating products are based on state-of-the-art research and are designed to exceed standards, meeting the needs of a broad range of users.<sup>[6]</sup>

5th Percentile Male and Female - 62.52", 55.78 kg,  
50th Percentile Male and Female - 64.15", 650.4 kg,  
95th Percentile Male and Female - 72.20", 108.07 kg

## SEATING COMFORT

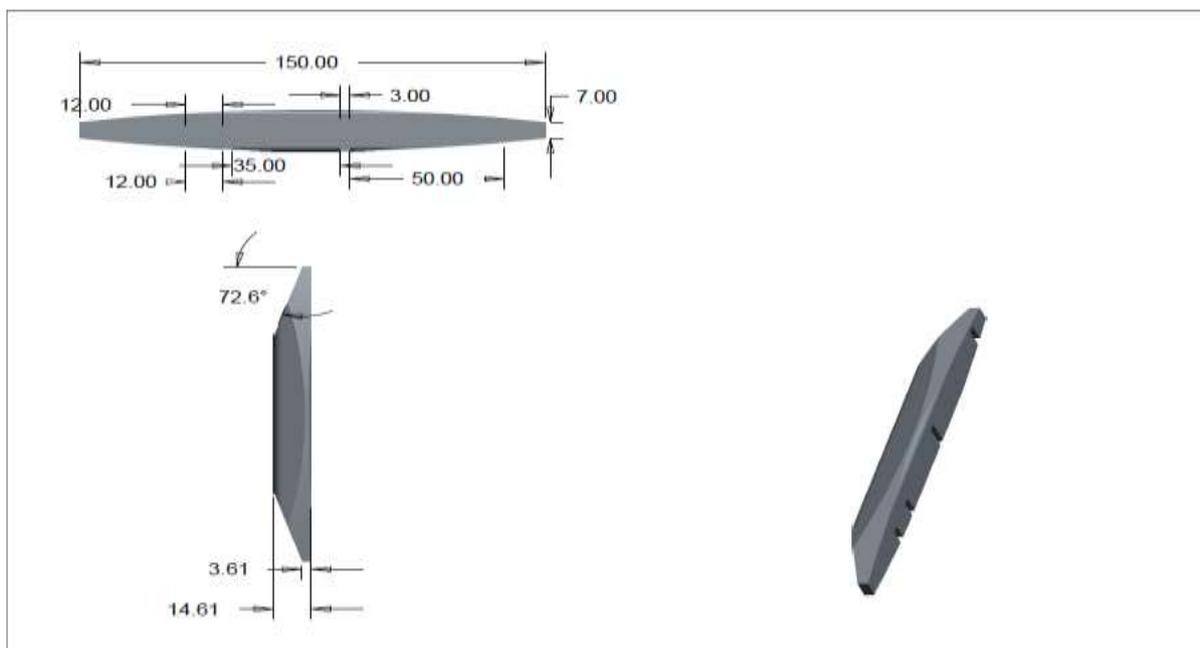
The true objective of an ergonomic chair is to provide not only the proper function but to ensure the more subtle yet all important aspects of user comfort. People who are more comfortable in their chairs are more likely to be able to sit and be productive for longer durations. Chairs that do not provide effective support and adjustability can significantly increase the spinal stresses resulting in discomfort and increased injury risk.<sup>[6]</sup>

### 4.4 Hull:

A hull is the watertight body of a ship or boat. Above the hull is the superstructure and/or deckhouse, where present. The line where the hull meets the water surface is called the waterline.

The structure of the hull varies depending on the vessel type. In a typical modern steel ship, the structure consists of watertight and non-tight decks, major transverse and watertight (and also sometimes non-tight or longitudinal) members called bulkheads, intermediate members such as girders, stringers and webs, and minor members called ordinary transverse frames, frames, or longitudinal, depending on the structural arrangement. The uppermost continuous deck may be called the "upper deck", "weather deck", "spar deck", "main deck", or simply "deck". The particular name given depends on the context—the type of ship or boat, the arrangement, or even where it sails. Not all hulls are decked (for instance a dinghy).

In a typical wooden sailboat, the hull is constructed of wooden planking, supported by transverse frames (often referred to as ribs) and bulkheads, which are further tied together by longitudinal stringers or ceiling. Often but not always there is a centreline longitudinal member called a keel. In fibre glass or composite hulls, the structure may resemble wooden or steel vessels to some extent, or be of a monologue arrangement. In many cases, composite hulls are built by sandwiching thin fibre-reinforced skins over a lightweight but reasonably rigid core of foam, balsa wood, impregnated paper honeycomb or other material.



*Fig. 4.4.1.Hull*

### General Features:

The shape of the hull is entirely dependent upon the needs of the design. Shapes range from a nearly perfect box in the case of scow barges, to a needle-sharp surface of revolution in the case of a racing multihull sailboat. The shape is chosen to strike a balance between cost, hydrostatic considerations (accommodation, load carrying and stability), hydrodynamics (speed, power requirements, and motion and behavior in a seaway) and special considerations for the ship's role, such as the rounded bow of an icebreaker or the flat bottom of a landing craft.

### Hull Shape:

Hulls come in many varieties and can have composite shape, (e.g., a fine entry forward and inverted bell shape aft), but are grouped primarily as follows:

Chined and Hard-chined. Examples are the flat-bottom (chined), v-bottom and multi-bottom hull (hard chined) have at least one pronounced knuckle throughout all or most of their length moulded, round bilged or soft-chined. Examples are the round bilge, semi-round bilge and s-bottom hull.

### 4.5 Rudder:

A rudder is primary control surface used to steer a ship, boat, submarine, hovercraft or other conveyance that moves through fluid medium on a air craft the rudder is used primarily to counter adverse yaw and P-factor and is not the primary control used to turn the boat. A rudder operate by the redirecting the fluid past the hull or fuselage, thus imparting a turning or yawing motion to craft. In a basic form a rudder is flat plane or sheet a material attached with the hinges to the craft's stern ,tail,or after end . Often rudders are shape so as to minimize hydrodynamic or aerodynamic drag. On the simple water craft a tiller essentially or pole acting as lever arm may be attached to the top of the rudder to allow it to be turned by a helmsman. The rudder is operated by pedal via mechanical linkage.

Boat rudders may be either outboard or inboard. Outboard rudders are hung on the stern or transom. Inboard rudders are hung from a keel and are thus fully submerged beneath the hull ,connected to the steering mechanism by a rudder post which comes up through the hull to deck level often into cockpit . Inboard keel hung rudders are traditionally deemed the most damage resistant rudder for off

shore sailing. Better performance with the faster handling characteristic can be provided by the skeg hung rudders on boats with smaller fin keels.

A rudder post an mast placement defines the difference between a ketch and yawl as these two masted vessels are similar .Yawls are defined as having the mizzen mast the rudder post; the ketches are defined as having the mizzen mast forward of rudder post . The small boat rudders that can be steered more or less perpendicular to hull longitudinal axis makes effective brakes when pushed hard over. However turns such as “hard over” ,“hard to starboard” etc. A signify a maximum rate turns for a large vessels. Transom hung rudders or far aft mounted fin rudders generate greater moment and faster turning than more forward mounted keel hung rudder.

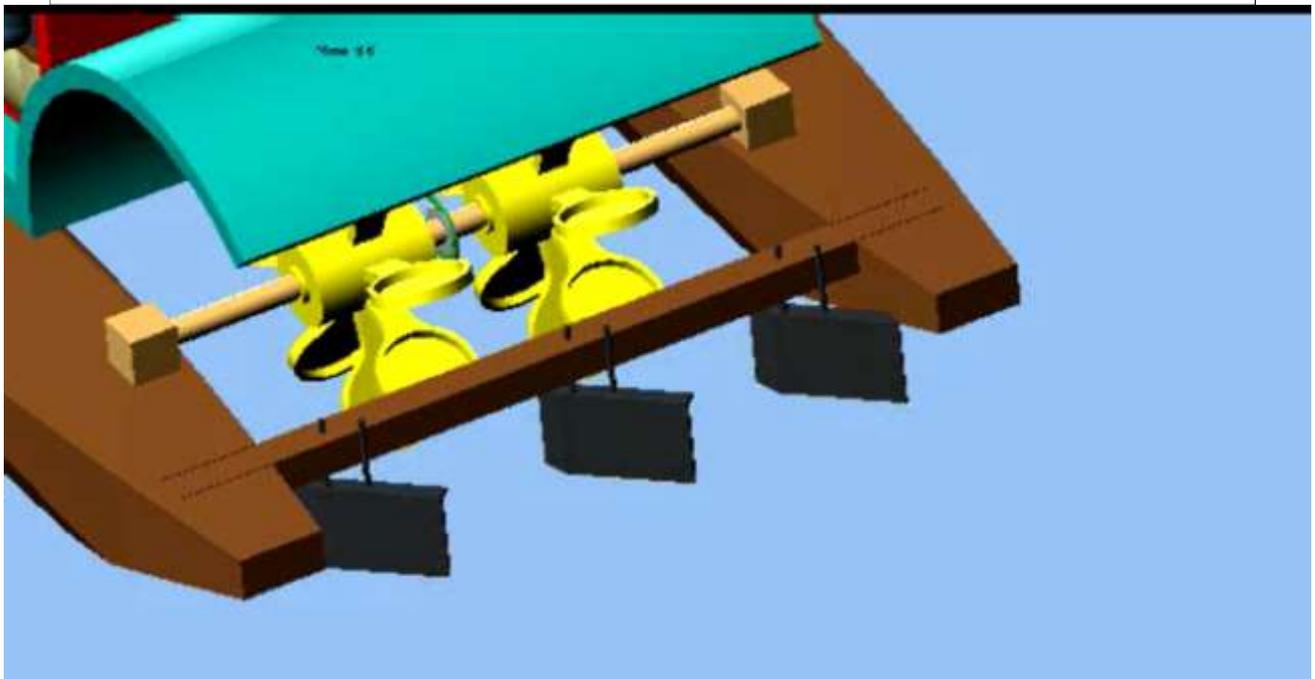
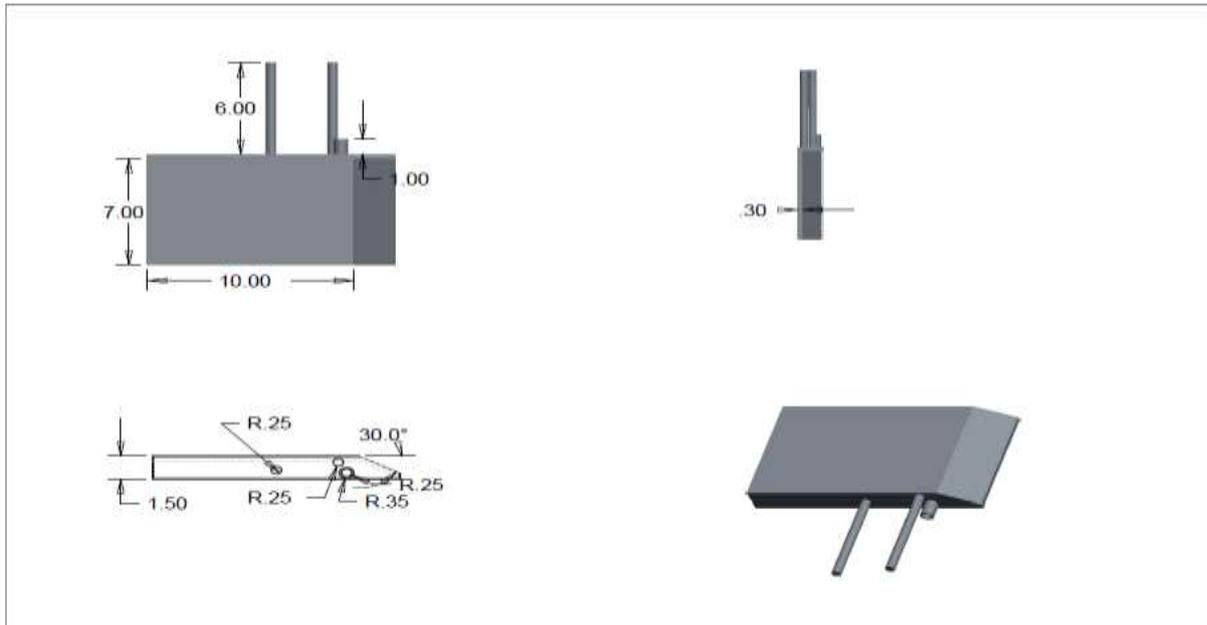
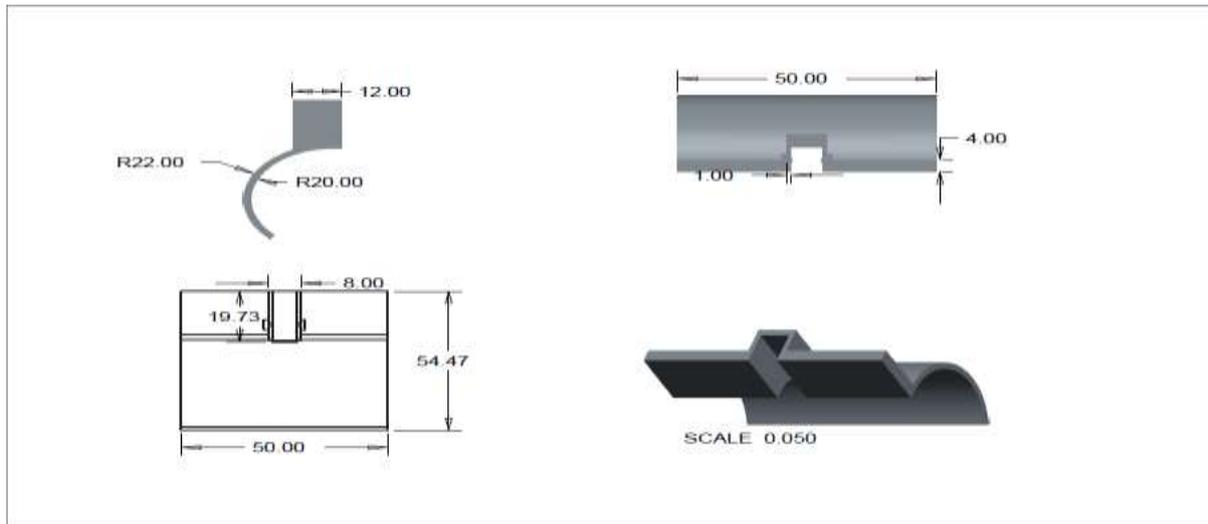


Fig 4.5.1 ruddder

#### 4.6 Casing:

casing is act as protective covering for the propellers present at the rear end of the boat. It can also prevent the sprinkling water toward the human in the boat. Casing is essential for the prolonged life of the boat.



*Fig. 4.6.1.Casing*

Good casing also increases the life of boat. In our project the casing is of 50 inch length and curve having radius 20 inch.

#### **4.4. PEDAL:**

Different kinds of pedals which are used for pedalling the boat, but we used basic platform pedals. Basic platform pedal are the most common type of pedals. Design for any type of footwear (or none at all!), basic platform pedals are comely found on kids' bikes as well as adult cruiser and comfort bikes. Rubber or hard plastic are the most frequently used material for this type of pedal.<sup>[7]</sup> Advantages are Simple to use, No specialized footwear needed. Disadvantages are No power transferee to the pedal on the upstroke i.e. you can push down on platform pedals, but you can't pull up on them when pedalling, easy for feet to slip off pedals.<sup>[7]</sup>

#### **4.5 Specifications:**

Dimension: 156 inch long \* 80 inch wide

Maximum capacity: 2 seats (200 kg)

Maximum capacity with garbage: 210 kg

Propulsion: 2

Pedals: 2 Pair

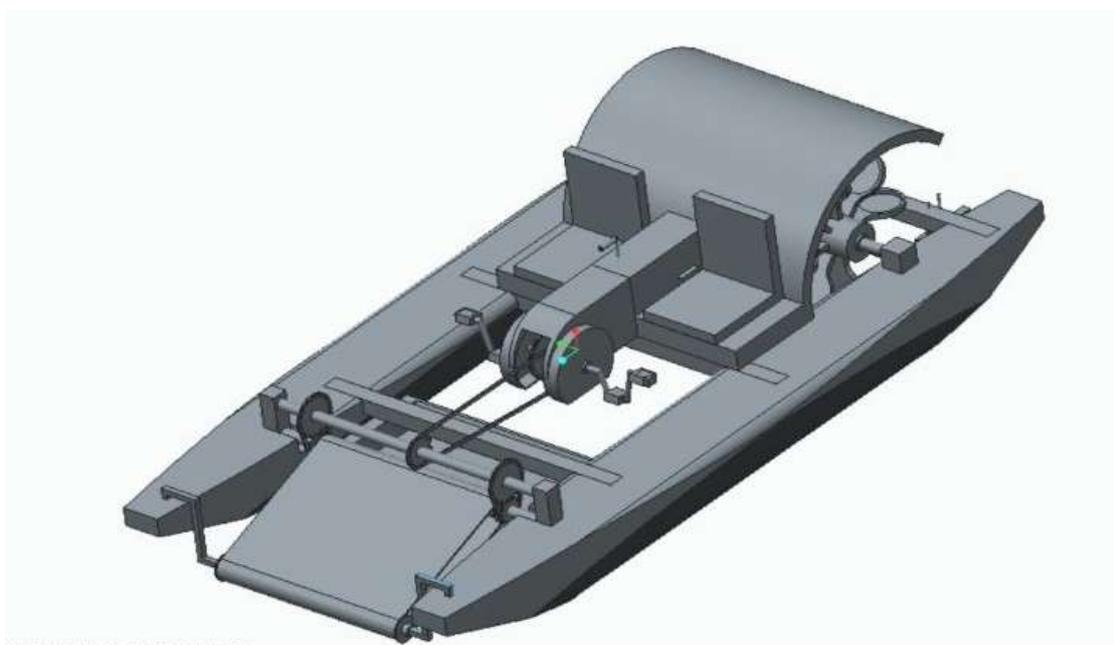
Conveyor: Length 32 inch, Width 36 inch, Angle 20<sup>0</sup> inclined to horizontal

Collector Box: Length 25 inch, Width 48 inch, Thickness 5inch

No. Of Rudder: 3

Shell material : Fibre glass composite

Conveyor material : Heavy duty stainless steel



*Fig 4.5.1 Pedal boat with conveyer*

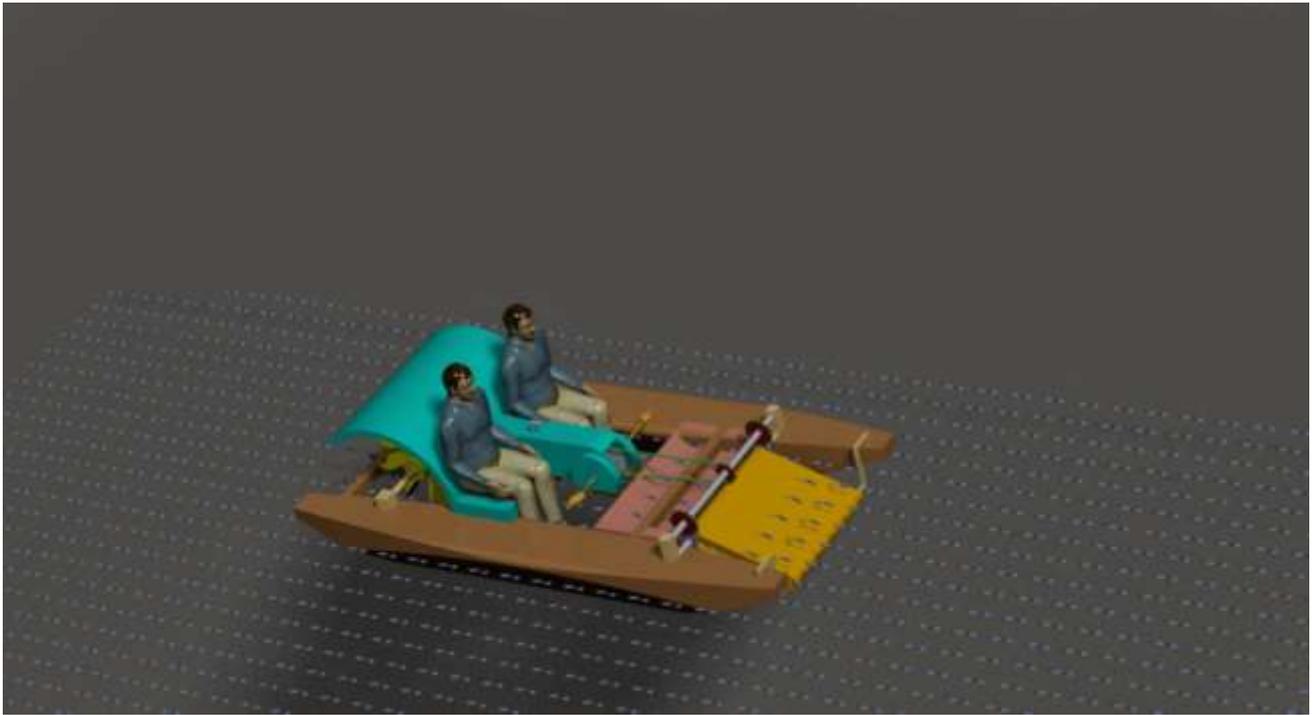
## CHAPTER V

### 5.1. Working:

We focused on bicycle mechanics in which pedal mechanism is used. We used chain drive for transmitting the power to the propeller for forward movement of the boat and also conveyer for collecting the garbage into box like structure in the boat.

One chain linking the gear which is fixed in the shaft of pedals and one side of central gear, second chain linking the another side of central gear to the gear which is fixed in the propeller shaft for forward movement of boat. Third chain linking the another gear which is fixed in the shaft of the pedal and small gear which is fixed in the front shaft. Gear (large gear at front shaft) and pinion mechanism is used for backward movement of pinion, due to which conveyer belt rotate in backward movement for collecting the garbage into box like structure in the boat. For steering the boat we used rudder at rear side which is connected to the handle by steering rod.

When we done the pedalling the pedal rotate in clockwise direction because of this the propeller which is linked by this pedal which is at the rare end of the boat also rotate in clockwise direction and helps the boat to go forward . Likewise when the pedal is rotating clockwise at the same time the conveyer present at front side of the boat start rotating in anti clockwise direction. When the boat is moving forward the conveyer rotates in anticlockwise direction and collects the floatable waste or garbage which comes in front of it. When the garbage collector is full then we can lift the conveyer and detach the collector from the boat, and remove all the garbage present in the collector. Once the collector is done empty then it again attached to the boat for further garbage collection. In this way we can collect the floatable garbage present in lake or rivers without using any kind of fuel.



*Fig. 5.1.1 Working of pedal boat*



*Fig 5.1.2 Actual image of our project*

## VI. BENEFITS & LIMITATIONS

### 6.1 Benefits:

- No consumption of fuels, fuels like petrol or diesel can be saved because of the pedal operated system.
- Beneficial for small as well as big lake, where garbage is present in large amount. We can collect this garbage and clean the lake.
- Its initial cost is less.
- Less maintenance. There is no such system where regular maintenance is required.
- It overcomes the water pollution.

### 6.2 Limitations:

- The boat is pedal operated so that we require power of a human being and which is equal to the weight of collected garbage by boat.
- The boat is running on water due to which it is limited to collect waste which is only floating on the water level.
- The waste collecting capacity of the boat at a time is limited.

## VII. FUTURE SCOPE

In the future, this project can be improved to sort more categories of waste. In this system, we can use an advanced conveyor system and conveyor material to increase the efficiency of garbage collection. We can use solar panels to provide power to the boat instead of a pedal-operated system. To modify the size of the boat according to its waste collecting capacity, it can be used in large lakes and rivers like the Ganga. This project can be useful in the Clean Ganga mission.

### VIII. CONCLUSION

This project focused on modelling, design and control of pedal operated boat, with emphasis on lightweight, portable appliances. An innovative method of minimizing manual stress and thus reliably stabilizing the garbage collect in the boat. The project carried out by us made an impressive task in the environmental purpose. It is very useful for the small scale works. This project has been designed to perform the entire requirement task, which has also been provided.

Although this system able to collect the garbage from the lake with human intervention. The objective of the project was successfully achieved.

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