A Minor Project on

Boat 500

By

Abhinav Vaidya	MESYB106
Rahul Gite	MESYB110
Durgesh Kolte	SEE021

Under the guidance of:
Prof. Vinod Pakhale

School of Mechanical and Civil Engineering
MIT Academy of Engineering [2018-19]

MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

C E R T I F I C A T E

This is to certify that Mr. ……, has successfully completed the Minor Project entitled "**Boat 500**" under my supervision for partial fulfilment SYBTECH Minor Project Curriculum.

Date:

Place:

Project Advisor's (Sign)_____ External Examiner(Sign) 1._____

2._____

Dean _____

ACKNOWLEDGMENT

It gives an immense pleasure to present the minor project entitled as **"BOAT 500",** but it would be purely unfair if we do not acknowledge the support and effort of some of the people without whom this dissertation would not have been successful.

First and foremost, we extend sincere thanks to our respected project advisor, **Prof. Vinod Pakhale** for his valuable guidance in this topic, also he has been a persistent source of inspiration to us.

We also would like to express our gratitude to the Dean of School of Mechanical and Civil Engg., **Prof. P. R. Hatte** and Minor Project coordinator **Mr. Ashwin S. Chandore**, teaching and non-teaching staff from Mechanical Engineering Department for their valuable support.

Most importantly we would like to extend our sincere gratitude towards our family and friends for always being there during needy times.

ABSTRACT

In today's world the availability of fresh water is decreasing day by day. And the main factors responsible for lesser availability are we, the humans, who not only over exploit the natural resources of water but also pollute them. So when we realized the same, we decided to make something which at least can remove all the solid wastes from the water bodies and make it easy for all the further chemical and physical treatments. We designed a boat which removes most of the solid waste from water.

First we designed a prototype model on SOLIDWORKS. Then we decided to use flex sheet as a basic building block for our physical model as it was cheap and easier to work on. So we have just made a small prototype of what actual boat will look and work like when manufactured. We truly hope that we could reduce the efforts of people working hard to keep it clean and maintained as it used to be. This project of ours is aimed to work autonomously or manually (via wireless controller) with least of efforts and all control over tip of the finger.

As far as Mechanical and Electronics aspect is concerned we gave our best to make our product robust as well as user friendly. Anyone with no prior knowledge can learn to use the product in no time. This product which is capable to do things with minimal efforts.
The title name includes 500 because it was designed to handle at least of 500 grams of solid waste at a turn as a small scale model. With proper conveyor this Boat 500 can be also deployed for land purposes and can become a hybrid solid waste cleaning vehicle with maximum efficiency and comfortability.

Being one of its kinds it consumes less energy and does maximum work at hand. It is flexible to its limits and easier to use compared to other sophisticated products in market till date. This is made to create a revolution in its own kind and change the current timeline of automation paired with Environment cleaning aspect.

INDEX

LIST OF FIGURES

CHAPTER 1

1. INTRODUCTION

1.1 WATER POLLUTION (SOLID WASTE)

Water is essential to life. Solid waste impacts water quality through the release of leachate from landfills into water sources. As water comes in contact with decomposing solid waste, it will dissolve together with soluble inorganic and organic wastes producing polluted liquid known as leachate or waste juice.

The concentration of leachate increases as it seeps into deeper layers of the landfill; this contributes to the light brown/black colour of leachate and its horrible stench (which is pretty similar to the smell you get from our drains due to the rotting waste that people have thrown in there). It has a high polluting potential impact due to its high concentrations of organic contaminants and high ammoniac nitrogen. Once leachate is discharged into water bodies or/and aquatic environment, it will have an acute and chronic impact. If toxic metals are present, this can lead to chronic toxin accumulation in organisms that depend on it and may consequently affect humans if we feed on these organisms (e.g. fish, prawns, crabs etc.)

1.2 EUTROPHICATION

Eutrophication or hypertrophication is when a body of water becomes overly enriched with minerals and nutrients which induce excessive growth of plants and algae. This process may result in oxygen depletion of the water body. One example is an "algal bloom" or great increase of phytoplankton in a water body as a response to increased levels of nutrients. Eutrophication is often induced by the discharge of nitrate or phosphate-containing detergents, fertilizers, or sewage into an aquatic system.

1.3 METHODS OF REMOVAL

- Disposal or reuse
- Phase separation
- Sedimentation
- Hand Picking
- Trash skimmers
- Filtration

CHAPTER 2

2. LITERATURE REVIEW

2.1 REVIEW OF BOOK AND INTERNATIONAL PAPER

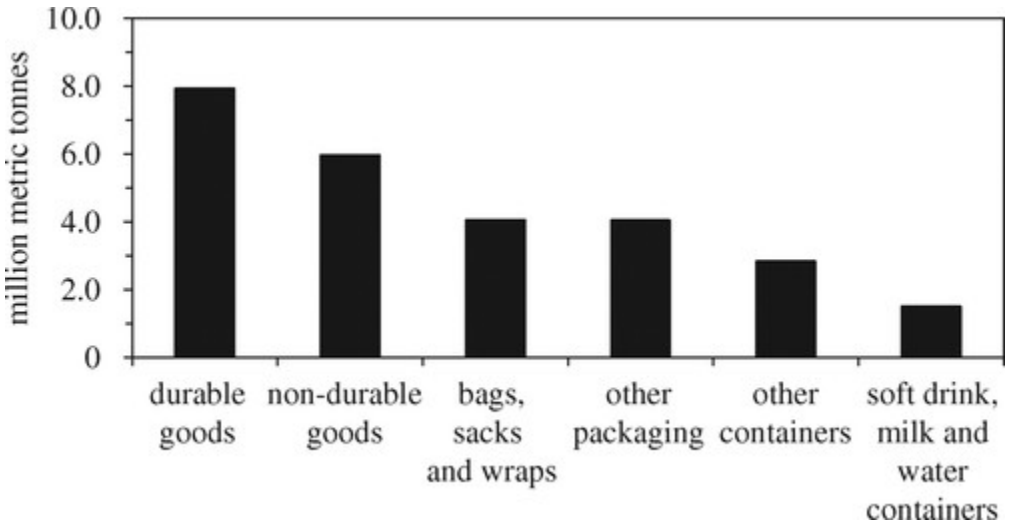
Published in: 2017 Systems and Information Engineering Design Symposium (SIEDS)
Date of Conference: 28-28 April 2017
Date Added to IEEE Explore: 01 June 2017
ISBN Information:
INSPEC Accession Number: 16930180
DOI: 10.1109/SIEDS.2017.7937696`
Publisher: IEEE
Conference Location: Charlottesville, VA, USA

Abstract:

The amount of human generated debris entering the oceans was recorded at eight billion kilograms (kg) in 2010, and has been rising exponentially by 10% each year. The most common pollutant is plastic which composes about 80% of the debris. Plastic takes approximately 500 years to decompose, and in that time, it is harming wildlife while collecting in the ocean's circular currents called gyres. The Subtropical Convergence Zone, stretching between California and China, contains the largest of the five major gyres, the North Pacific Subtropical Gyre, which is located between California and Hawaii. The estimated cost of environmental damage from human generated debris is about three billion dollars. Seven design alternatives are evaluated: autonomous vacuum (AV), vessel with nets (VN), barge with unmanned aerial vehicles (B-UAV), artificial floating island (AFI), artificial floating island with sail (AFI-S), and artificial floating island with motor (AFI-M), and barge with autonomous surface vehicles (B-ASV). Using a multi-attribute utility function, the best alternative was determined per weights associated with performance, technology readiness level (TRL), and risk. The design alternatives are ranked as follows: AV at 8.461, AFI-M at 7.188, AFI-S at 6.849, B-UAV at 6.571, AFI at 6.221, VN at 4.288, and B-ASV at 2.287. The weight that significantly changes the value of the design alternatives is performance. With a change in the weighs, the optimal solution changes from the AV to the AFI-M. The most viable option is the AV; one AV would clean up the

Subtropical Convergence Zone in approximately 5700 years while 5700 AVs would clean up the debris in one year.

In the USA, durable goods, products that last on average for >3 years and include items such as furniture and appliances, were the most important use for new plastics (figure 1). Non-durable goods, products that are consumed in <3 years such as trash bags and eating utensils, were the next biggest use category. In Europe, data on various packaging applications are typically combined rather than considered separately and hence disposable packaging represents the principal use of plastics



2.2 CONCLUSION DERIVED FROM LITERATURE REVIEW

Less than 60 years ago, the mass production of plastics started and now most items that people use, virtually anywhere on the planet are partly or wholly made of this inexpensive, durable material. Plastics have transformed the surface of the planet, far beyond areas of human population density—fragments of all sizes are ubiquitous in soils to lake beds, from remote Antarctic island shores to tropical seabed. Plastics turn up in bird nests, are worn by hermit crabs instead of shells and are present in turtle stomachs. Humans generate considerable amounts of waste and the quantities are increasing as standards of living and the population increase. Although quantities vary between countries, approximately 10 per cent of solid waste is plastic. Up to 80 per cent or sometimes more of the waste that accumulates on land, shorelines, the ocean surface or seabed is plastic. The most common items are plastic films, such as carrier bags, which are easily windblown, as well as discarded fishing equipment and food and beverage packaging. Strandline surveys (beach-cleaning operations) are now organized in many countries and provide information about temporal and spatial trends. However, these surveys typically only provide data on coarse trends and larger items. There is considerable variation in methodology between regions and between investigators, and more valuable and comparable data could be obtained by standardizing monitoring approaches (Ryan et al. 2009). Accumulation rates vary widely with many factors such as proximity of urban settlements, shore use, prevailing wind and ocean currents and region. There were dramatic increases in quantities of mega- and macro-plastic debris in the northern hemisphere up to the 1990s. Quantities of debris in the oceans appear to have stabilized over the last decade but have increased on shorelines. However, this could indicate quantities of debris entering the sea are declining, but the material already in the sea is progressively being deposited on the shore or sinking to the deep. As on beaches and the ocean surface, enclosed seas such as the Mediterranean have the highest densities, but investigations in deeper waters have shown that high accumulation rates can stretch far (hundreds of kilometers) from the coast, particularly adjacent to large river mouths or in canyons. As in surface environments, trends of debris accumulation on the seabed increase at some locations, but are stable or decreasing at other sites. Quantities of debris in the oceans appear to have stabilized in the oceans over the last decade but have

increased on shorelines. The problem of plastic fragments has taken on increased importance in the last few decades. From the first reports in the 1970s, it was only a few years before the widespread finding of plastic including reports of microscopic fragments (20 μm in diameter). The abundance of microscopic fragments was greater in the 1980s and 1990s than in previous decades. It has also been suggested that plastic waste is deliberately being shredded into fragments to conceal and discarded at sea. Plastics of all sizes are now reaching the most remote and deepest parts of the planet, and although we have much better knowledge of their sources, quantities and distribution, we still understand little about their longevity and effects on organisms. Further, we have made little progress in reducing the release of plastic to the environment (see discussion in Thompson et al.2009). Temporal trends of macro-plastics on remote islands suggest that regulations to reduce dumping at sea have been successful to some extent. However, our sustained demand for plastic means that contamination of the environment by micro-plastic pieces seems set to increase. In addition, future sampling may reveal increasing quantities of debris in the planet's least known habitat, the deep sea.

CHAPTER 3: OBJECTIVE

3.1 PROBLEM STATEMENT

In today's world the availability of fresh water is decreasing day by day. And the main factors responsible for lesser availability are we, the humans, who not only over exploit the natural resources of water but also pollute them.

3.2 NECESSITY OF WORK:

When we open the tap, clean tasty water flows out. Water undergoes several purification steps before it flows from taps. Water that is used for drinking water production contains water molecules and a large variety of other substances. One of the properties of water is that it easily dissolves other substances. Water that falls to earth during rain showers dissolves substances, particles and gasses such as oxygen, which can be found in air. Contaminants that are present in air also dissolve in rain water. When surface water flows on earth it also dissolves several different substances, such as sand particles, organic matter, microorganisms and minerals. Water that settles into the ground and becomes groundwater often contains large amounts of dissolved minerals, as a result of contact with soils and rocks. Human activities, such as agriculture and industrial waste and sewer water discharge cause a number of pollutants to enter the water.

3.3 OBJECTIVE OF WORK:

The main objective of our work is to remove the solid wastes from the water bodies as it may dissolve or react with water making it impure and toxic. So our objective is to remove the solid waste and make it easier for further chemical treatment

3.4 METHODOLOGY OF THE WORK

- Our model will be basically, similar to that of a boat
- It will have a conveyor belt mechanism
- The belt will have a bin at its end where all the waste will be collected
- The bottom of the boat made of cans which will allow our mechanism to float
- The conveyor will be driven via two motors
- We have also decided to control our boat via controller

CHAPTER 4: PROPOSED STRUCTURES FOR BOAT 500

4.1 INITIAL STRUCTURE

It has following components:

1. Base
2. Conveyor
3. Container
4. Complete assembly

1. Base

Our base is basically made from four rolling cylinders so as to make it work efficiently on both land and water. It is assembled in a similar manner to that of an army tank

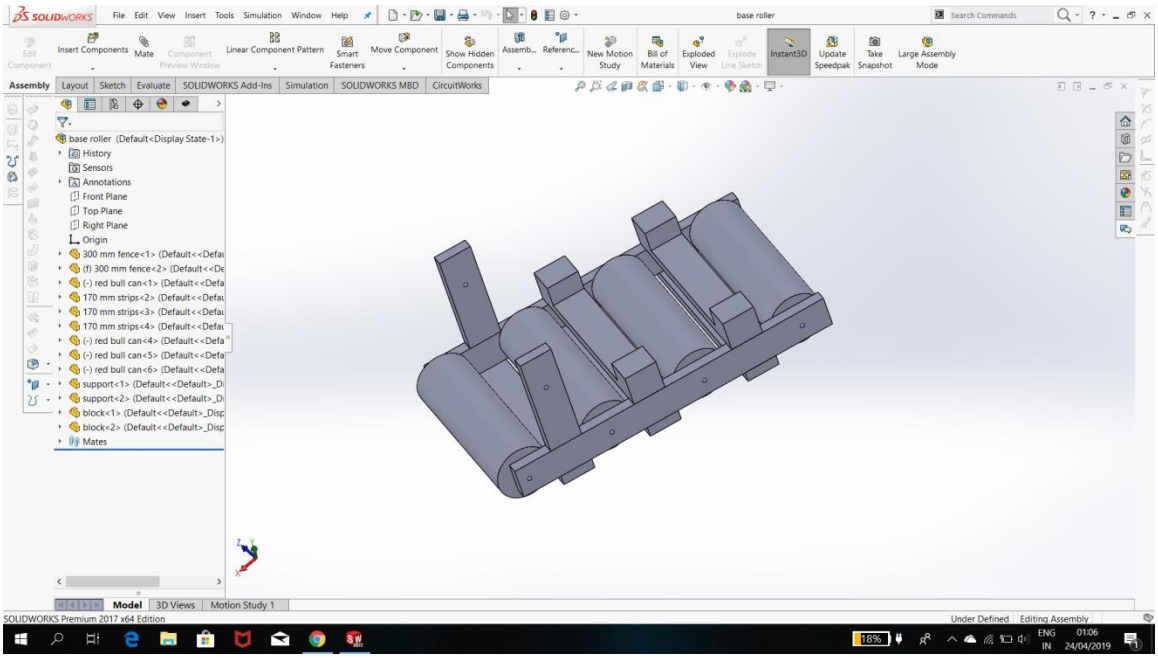


Figure no. 4.1 SOLIDWORKS model of base of the BOAT

2. Conveyor

To pick up the solid waste from the water bodies we have used a conveyor belt mechanism which will keep on rotating in turn moving the solid waste from water into the container assembled above the base

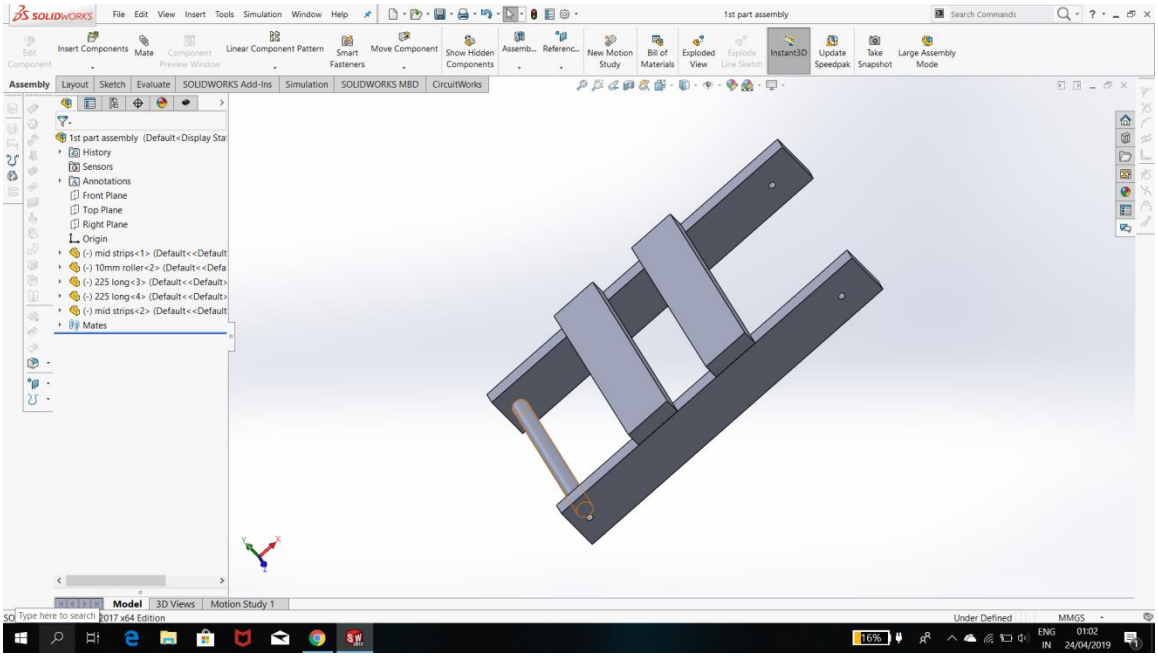


Figure no. 4.2 SOLIDWORKS model of Conveyor

3. Container

The collected waste is put into the container assembled above the boat

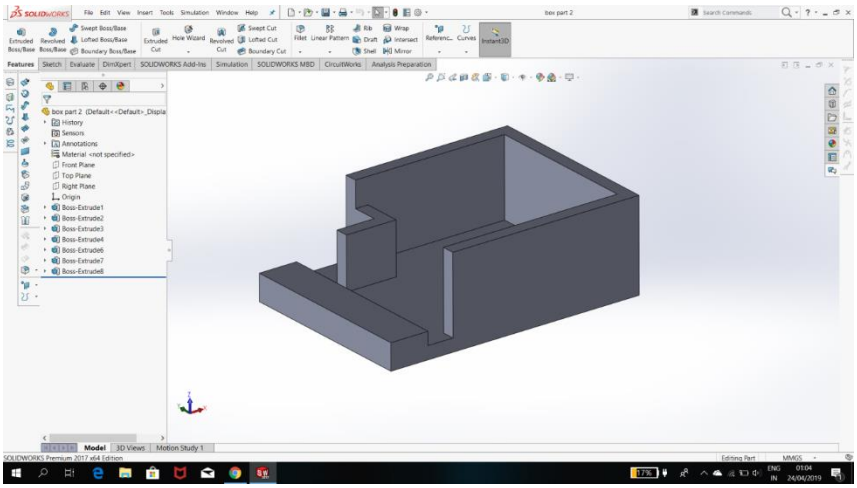


Figure no. 4.3 SOLIDWORKS model of container

4. Complete Assembly

Complete boat after assembling will look similar to that in below SOLDWORKS model

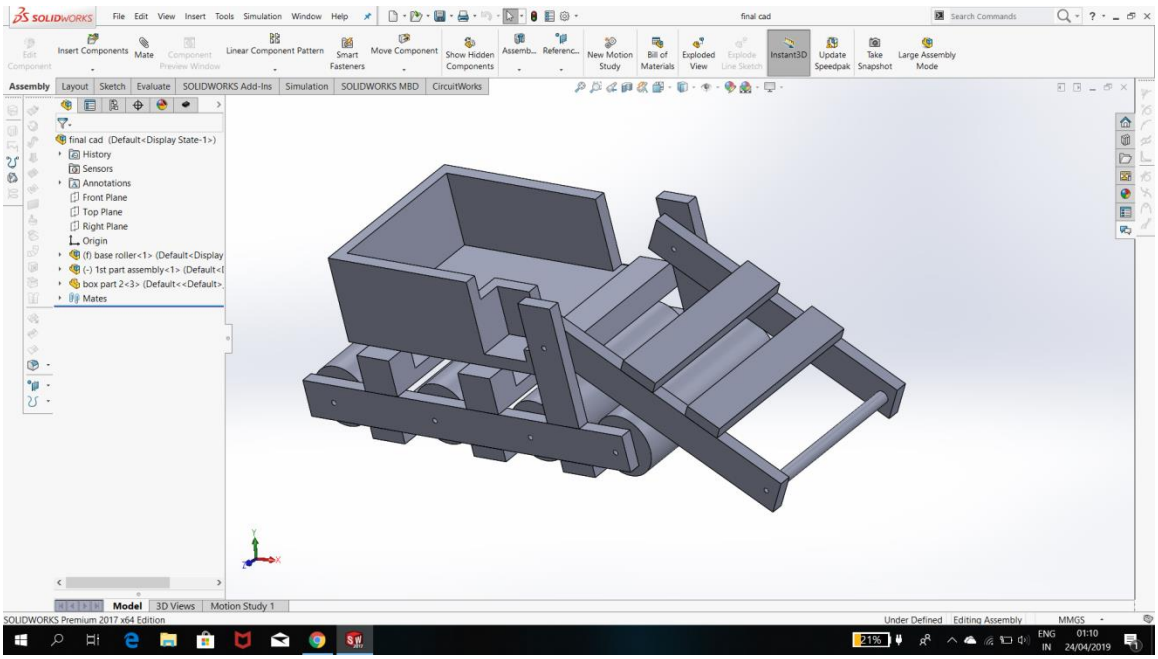


Figure no. 4.4 SOLIDWORKS model of Complete Assembly

4.2 WORKING:

The boat will be controlled either via mobile or a controller. Motion will be provided through two 100 rpm motors attached to one of the cans, which when rotates, provides motion to the boat. Also we have attached one more motor to the conveyor belt to rotate and collect the waste from the water bodies. And to change the direction we have used a servo motor.

4.3 OBSERVATION:

It is observed that the V- shape strip spring is great under part loading i.e. minimum loading action and main leaf spring is superior for maximum loading condition so that the whole unit of this progressive rate spring is best suitable for carrying export quality fruit from farm to wear house or customer market and mini ambulance vehicle. All material used in this unit is easily available, so it commercially adopted in automotive mini trailer manufacturer. Also, it has less complexity and economically advantageous for middle class farmer.

4.4 HARDWARES OR COMPONENTS USED

- L298N: Motor Driver to drive both Wheels
- Servo: movement of Propeller
- BO Motor: movement in forward and backward
- Overall: Through USB Host Shield the user will operate the robot for directions or Servo, which will be used as propeller.
- Arduino UNO
- USB Host Shield / Bluetooth Module
- Battery 12 Volt
-

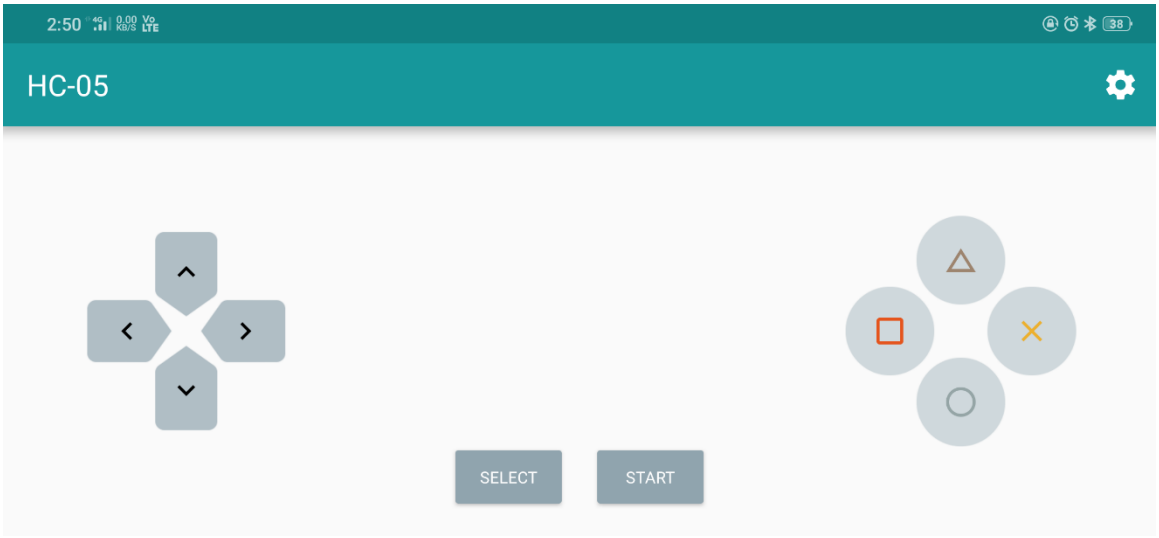


Figure 4.5

4.5 CODE

```
#include<Servo.h>
#define base1 3
#define base2 2
#define conv1 4
#define conv2 5
#define serv 6
Servo myservo;
int incomingByte = 0; // for incoming serial data

void setup() {
  myservo.attach(serv);
  pinMode(base1, OUTPUT);
  pinMode(base2, OUTPUT);
  pinMode(conv1, OUTPUT);
  pinMode(conv2, OUTPUT);
  Serial.begin(9600);
}

void loop() {

  if (Serial.available() > 0) {
    // read the incoming byte:
    incomingByte = Serial.read();
```

```
// say what you got:
Serial.print("I received: ");
Serial.println(incomingByte, DEC);


if (incomingByte == 49) {
  straight();
}
else if (incomingByte == 51) {
  back();
}
else if (incomingByte == 48) {
  left();
}
else if (incomingByte == 50) {
  right();
}
else if (incomingByte == 54) {
  stp();
}
if (incomingByte == 55) {
  convPick();
}
else if (incomingByte == 57) {
  convDrop();
}
```

```
    else if (incomingByte == 56) {
      convStop();
    }
  }
}

void straight() {
  Serial.println("Straight");
  digitalWrite(base1, HIGH);
  digitalWrite(base2, LOW);
  myservo.write(90);
}

void back() {
  Serial.println("Back");
  digitalWrite(base1, LOW);
  digitalWrite(base2, HIGH);
  myservo.write(90);
}

void left() {
  Serial.println("Left");
  digitalWrite(base1, HIGH);
  digitalWrite(base2, LOW);
  myservo.write(60);
```

```
}

void right() {
  Serial.println("Right");
  digitalWrite(base1, HIGH);
  digitalWrite(base2, LOW);
  myservo.write(120);
}

void stp() {
  Serial.println("Stop");
  digitalWrite(base1, LOW);
  digitalWrite(base2, LOW);
  myservo.write(90);
}

void convPick() {
  Serial.println("Conveyor Pick-Up");
  digitalWrite(conv1, HIGH);
  digitalWrite(conv2, LOW);
}

void convDrop() {
  Serial.println("Conveyor Drop");
  digitalWrite(conv1, LOW);
```

```
  digitalWrite(conv2, HIGH);
}

void convStop() {
  Serial.println("Conveyor Stop");
  digitalWrite(conv1, LOW);
  digitalWrite(conv2, LOW);
}
```

CHAPTER 5: CONCLUSION

5.1 Conclusion

As water pollution is one of the major concerns towards lesser availability of fresh water, we came up with a boat that cleans up the solid waste from water. Our boat is so light weight and user friendly. Also it is cost efficient. So we were successfully able to clean up the solid waste.

5.2 Future development and scope:

We can make the boat completely automated. We can use solar panels as an energy source to save energy. Also we can use it on land to clean the solid waste from land. Then we can also check the chemical content of water and treat it by adding some chemicals through boat.

CHAPTER 6:

MATERIAL AND COST ESTIMATION

Table no. 12.1 Cost Estimation

Sr. No	Parts	Quantity	Cost (Rs)
1	Arduino UNO	1	450.00
2	BO Motors	2	260.00
3	Servo Motor	1	350.00
4	Motor Drivers (L298N)	1	200.00
5	Lipo Battery (12 V)	1	700.00
6	Miscellaneous	-	100.00
			2060.00

References

https://ieeexplore.ieee.org/document/7937696

https://royalsocietypublishing.org/doi/full/10.1098/rstb.2008.0205

https://www.researchgate.net/publication/327433799_Plastic_Waste_is_Exponentially_Filling_our_Oceans_but_where_are_the_Robots

https://www.youtube.com/watch?v=fqd_RcD49ME

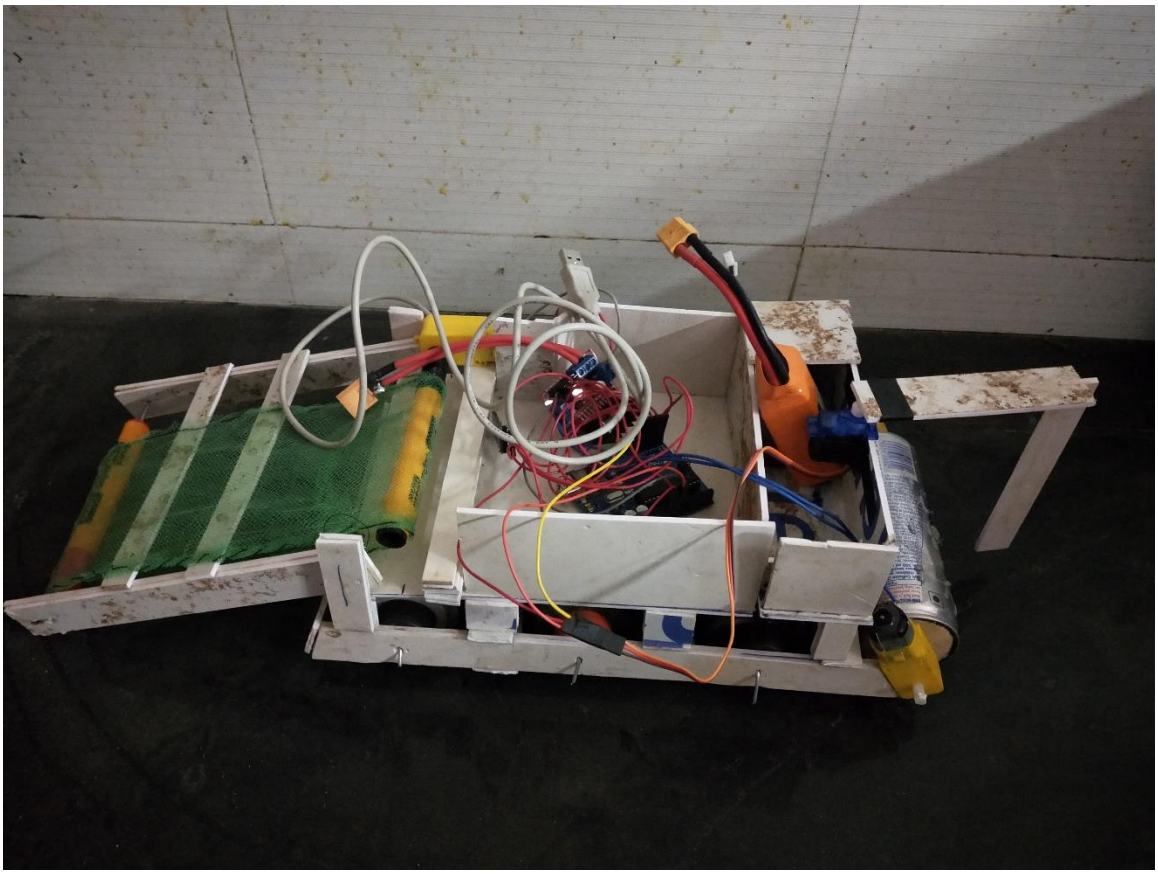


Figure 4.6