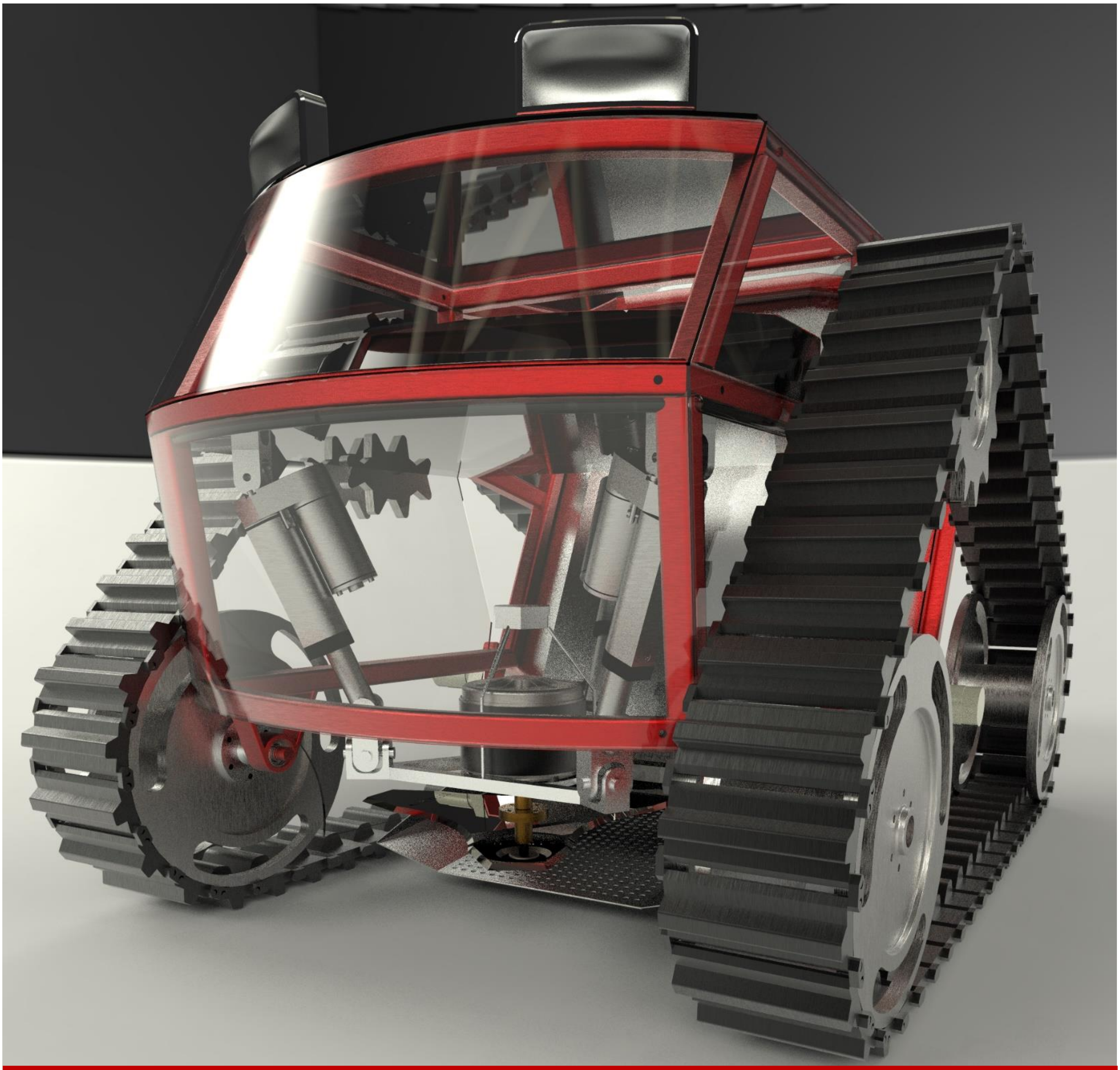


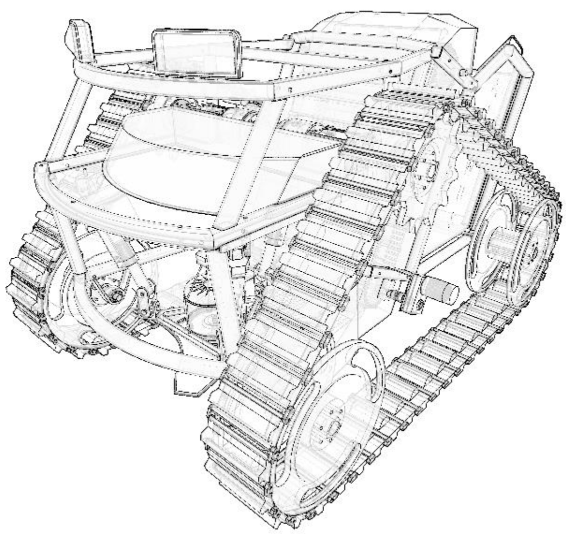
A.I.R.W.U.S.

Report

Team ID: 6924742071

AAKRUTI 2018

Index



Design Calculations

1. Motor Calculations

i) Drive Motors –

Mass of Subassembly	Radius of wheel	Required Torque
18.805 kg	8.80 cm	165.5 kg-cm

ii) Conveyer Motors –

The sub assembly is held by 2 motors. Hence the required torque is half of the calculated value for each motor.

Mass of Subassembly	Radius of wheel	Required Torque	Required Torque for each motor
3.338 kg	4.05 cm	13.59 kg-cm	6.795 kg-cm

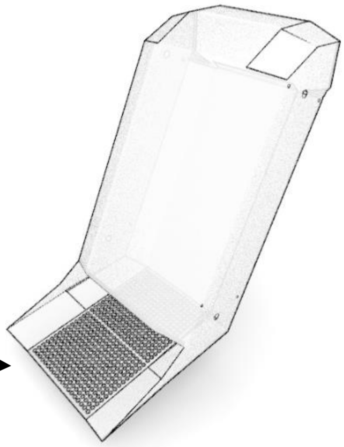
2. Weed collection calculations

Volume of primary scoop = 9780 cubic.cm

Volume of secondary scoop = 754 cubic.cm

Number of secondary scoops = 26

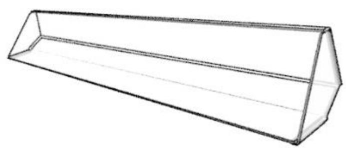
Volume of detachable module = 66580 cubic.cm



Weight of weed required in primary scoop to trigger conveyer Subassembly = 500g

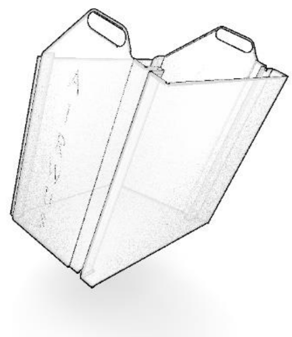
weight of weed carried by secondary scoop -

(754*500)/9780 = 38.5 g



weight of weed carried by detachable module -

(66580*500)/9780 = 3.403 kg



Number of secondary scoops required to fill detachable module -

3403/38.5 = 88.4 (88 scoops)

Number of cycles required to fill detachable module –

88.4/26 = 3.4 cycles

3. Field area covered by system to completely fill the detachable module

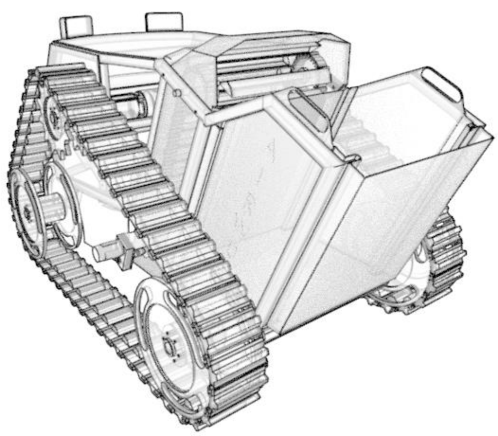
If a Y sq. m area grows X grams weed, then the area covered by system (A) is –

$$\mathbf{A = (Y*3403)/X}$$

e.g. y = 100 sq.m
x = 250 g

A = (100*3403)/250 = 1361 sq.m

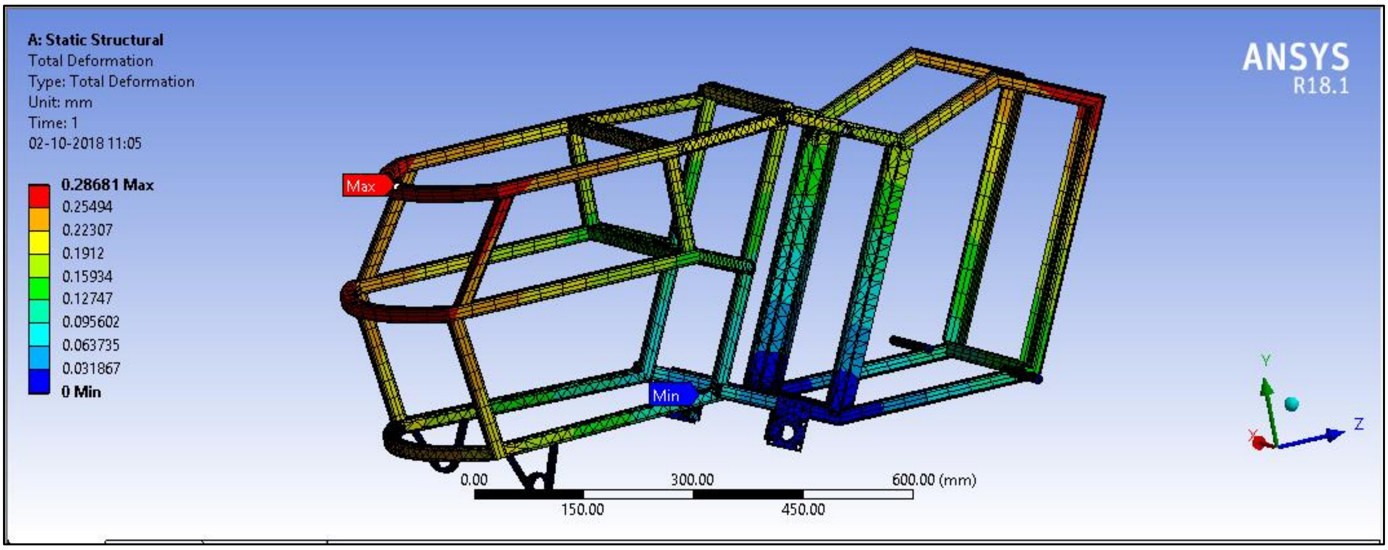
Once the area A is covered. The detachable module gets filled. Hence, the system goes to nearest docking point. The farmer evacuates the module manually.



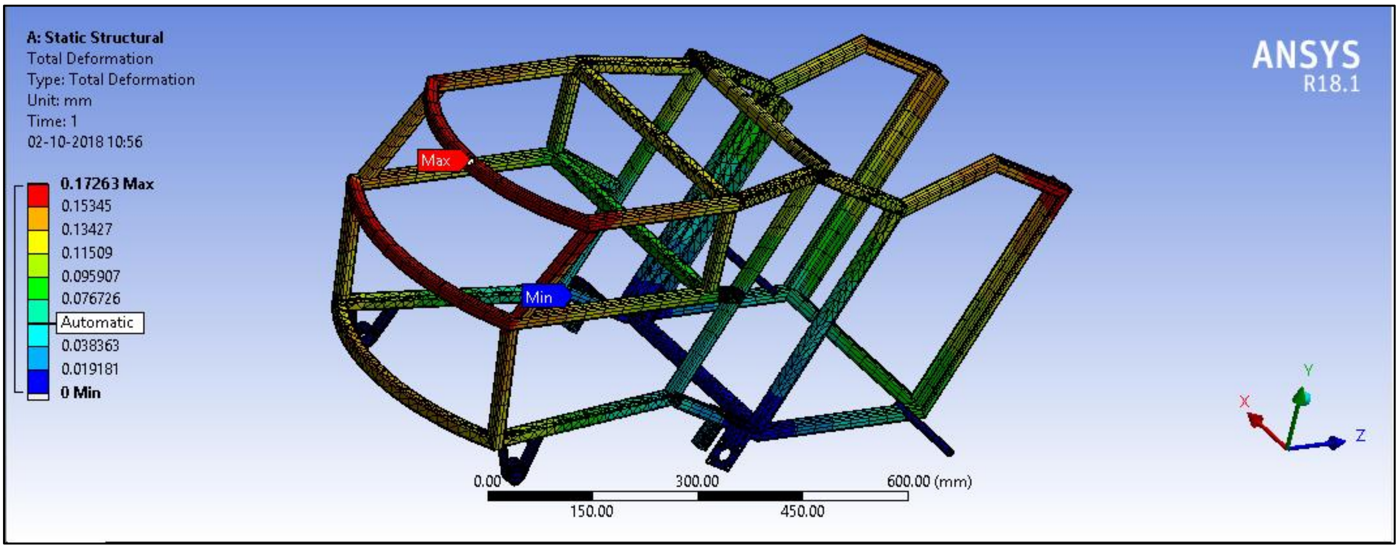
Simulation Report

STATIC ANALYSIS OF THE CHASSIS

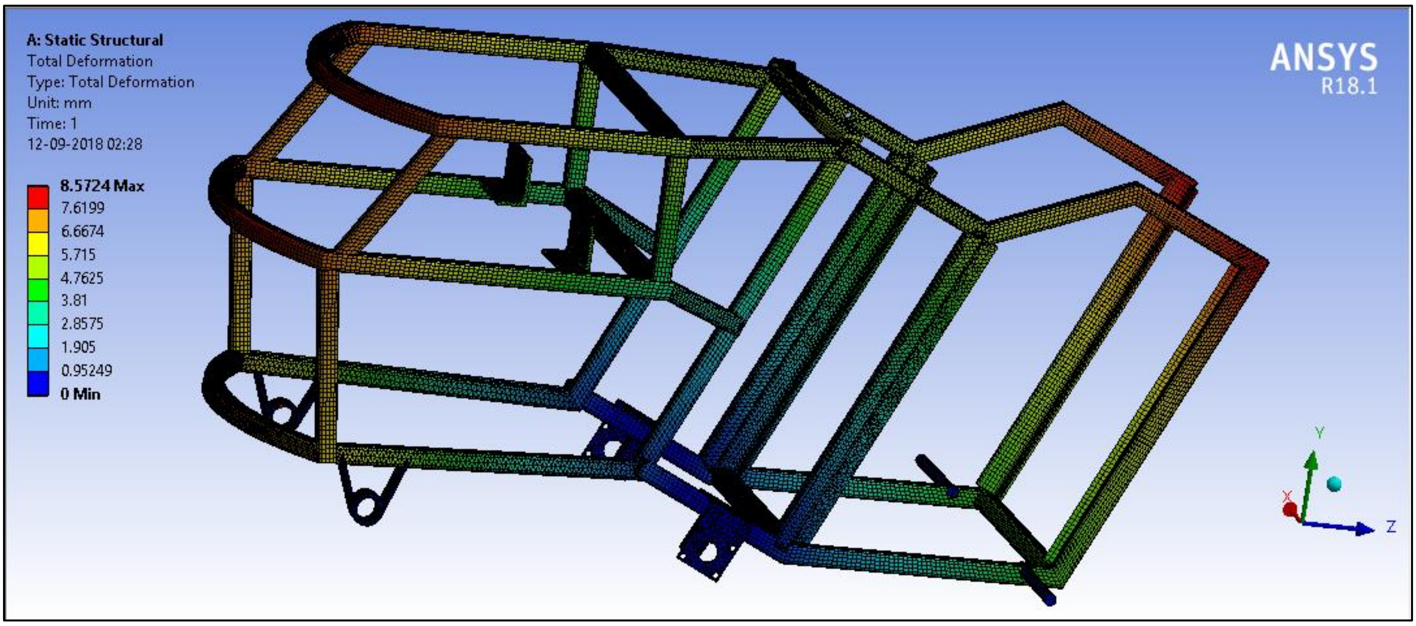
- Several Finite Element Analysis(FEA) were done on the chassis to decide the final material of the chassis.
- The approach used was by comparison.



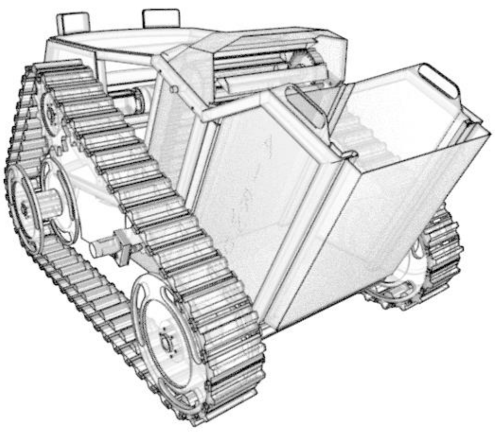
- The first material chosen was Galvanised Cast Iron and the deformation noted was based on self-weight.
- The maximum deformation noted was of 0.29mm.
- This was considered and kept for comparison with other materials.



- Next analysis was done on Structural steel and Aluminium 6061 Alloy. The deformations were similar in the range of 0.17mm
- Hence, cast iron was discarded due to greater deformation. The final deduction came down to the selection of structural steel and aluminium.
- Aluminium was chosen as it has a comparatively cheaper cost when compared to steel.



- This was an overtime deformation plot due to the weight of the components. Causing us to re-buy the chassis after around 8 years.



Costing Report

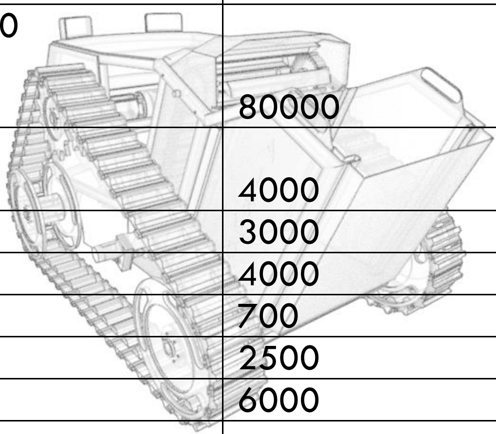
(generated using Solidworks Costing tool)

Estimated Cost per System – RS. 2,67,120

Cost Breakdown:

1) Parts to be bought-

S.No.	Part	Quantity	Price per unit (Rs.)	Total Cost (Rs.)
1	Flexible Shaft Coupler	2	400	800
2	Shaft With key	2	200	400
3	Shaft Without key	2	200	400
4	Drive shaft	4	800	3200
5	Caterpillar Drive belts	2	25000	50000
6	Timing Belt (Conveyer)	2	4000	8000
7	ISO - Spur gear	4	2000	8000
8	Angular Contact Ball Bearings	4	500	2000
9	Universal Joint 1	6	300	1800
10	Universal Joint 2	3	300	900
11	Universal Joint 3	3	300	900
12	Standard Cutting Blade	1	3000	3000
13	Standard L Mount for offset Shaft Motor	2	500	1000
14	Linear Actuator	3	3000	9000
15	Offset Shaft Geared DC Motor	2	2000	4000
16	Drive Motors- Magnum DC Geared Motors with encoder	2	40000	80000
17	BLDC Motor (Segway Motor)	1	4000	4000
18	Motor Drivers	1	3000	3000
19	BNO	1	4000	4000
20	Load Cell	1	700	700
21	Raspberry Pi 2	1	2500	2500
22	Battery	2	3000	6000
23	Battery management system	1	800	800
24	Wires	As required	1000	1000

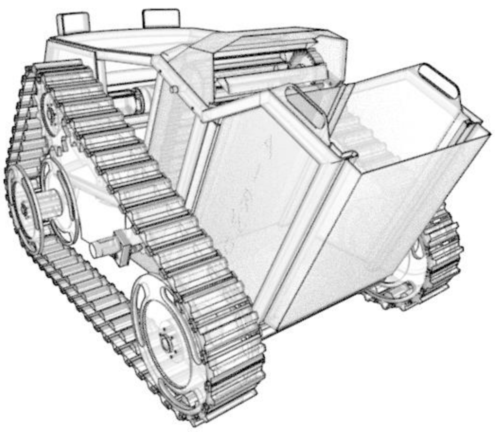


2) Parts to be machined-

S.No.	Part	Material Cost	Manufacturing cost	Total Cost (Rs.)
1	Chassis	42120	6000	48120
2	Detachable Module	4000	800	4800
3	Conveyer Enclosure	3000	800	3800
4	Scoop (26)	2000	800	2800
5	Idler Wheels/Pulley Wheel/Traction Wheel	2000	900	2900
6	Driving Wheel	1000	800	1800
7	BLDC Motor Frame	1000	2000	3000
8	Stewart Platform Table	500	1000	1500
9	Connecting Rod	500	300	800
10	BNO Mount	300	300	600
11	BLDC Coupler	500	300	800
12	Drive Couplers	500	300	800

3) Total Cost-

S.No.	Part	Total Cost (Rs.)
1	Parts to be bought	195400
2	Parts to be machined	71720
3	**Total**	**267120**



Sustainability Report

(generated using Solidworks Sustainability tool)

Environmental Impact (calculated using CML impact assessment methodology)

Carbon Footprint

Material:	5300 kg CO_2e
Manufacturing:	390 kg CO_2e
Use:	0.00 kg CO_2e
Transportation:	57 kg CO_2e
End of Life:	53 kg CO_2e

5800 kg CO_2e

Total Energy Consumed

Material:	6.6E+4 MJ
Manufacturing:	3900 MJ
Use:	0.00 MJ
Transportation:	760 MJ
End of Life:	39 MJ

7.1E+4 MJ

Air Acidification

Material:	35 kg SO_2e
Manufacturing:	5.5 kg SO_2e
Use:	0.00 kg SO_2e
Transportation:	0.524 kg SO_2e
End of Life:	0.027 kg SO_2e

42 kg SO_2e

Water Eutrophication

Material:	1.4 kg PO_4e
Manufacturing:	0.211 kg PO_4e
Use:	0.00 kg PO_4e
Transportation:	0.076 kg PO_4e
End of Life:	0.064 kg PO_4e

1.8 kg PO_4e

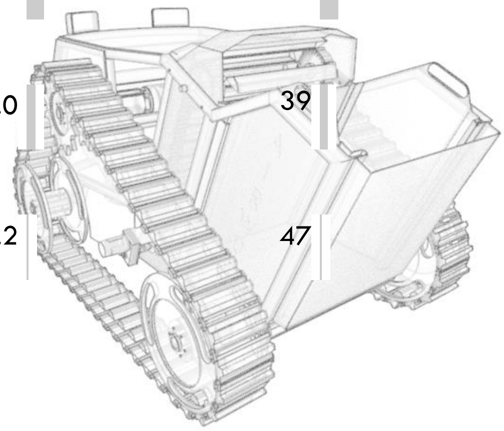
Material Financial Impact: 878.80 USD

System Weight	69.058 Kg
Built to last	8 years
Duration of use	8 years
Assembly process	Region: India
Use	Region: India
End of Life	Recycled: 8% Incinerated: 20% Landfill: 73%

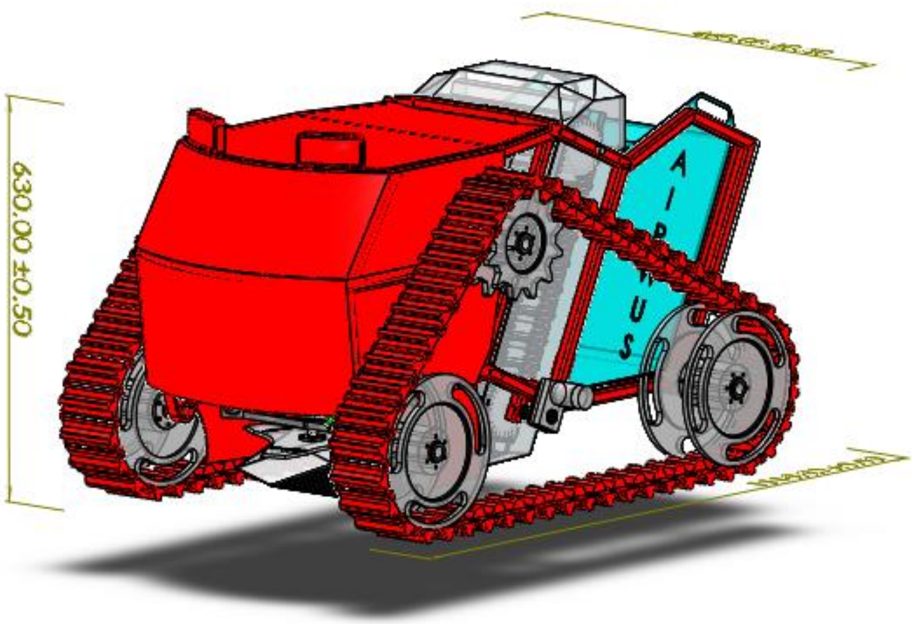
Component Environmental Impact

Top Ten Components Contributing Most to the Four Areas of Environmental Impact:

Component	Carbon	Water	Air	Energy
Chassis	160	0.037	1.1	1900
Belt (Drive)	150	0.035	1.1	1800
Top Platform	48	0.025	0.314	490
Traction wheels	32	7.3E-3	0.222	390
Belt (conveyer)	4.6	8.2E-3	4.3	22
Detachable Module	25	2.3E-3	8.3	300
Conveyer Enclosure	25	2.3E-3	8.1	300
Drive Wheels	12	2.1E-3	3.9	150
Cutting Blade	3.3	5.7E-4	1.0	39
spur gears	3.8	3.3E-4	1.2	47




RAW MATERIAL
EXTRACTION
MATERIAL
PROCESSING
PART
MANUFACTURING
ASSEMBLY
PRODUCT
USE
END OF LIFE
SUSTAINABLE
DESIGN


630.00 ±0.50

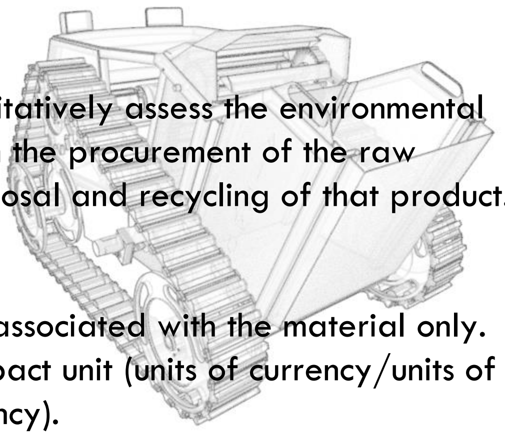
Glossary

Air Acidification - Sulphur dioxide, nitrous oxides other acidic emissions to air cause an increase in the acidity of rainwater, which in turn acidifies lakes and soil. These acids can make the land and water toxic for plants and aquatic life. Acid rain can also slowly dissolve manmade building materials such as concrete. This impact is typically measured in units of either kg **sulphur dioxide equivalent (SO_2), or moles H+ equivalent.**

Carbon Footprint - Carbon-dioxide and other gasses which result from the burning of fossil fuels accumulate in the atmosphere which in turn increases the earth's average temperature. Carbon footprint acts as a proxy for the larger impact factor referred to as Global Warming Potential (GWP). Global warming is blamed for problems like loss of glaciers, extinction of species, and more extreme weather, among others.

Total Energy Consumed - A measure of the non-renewable energy sources associated with the part's lifecycle in units of megajoules (**MJ**). This impact includes not only the electricity or fuels used during the product's lifecycle, but also the upstream energy required to obtain and process these fuels, and the embodied energy of materials which would be released if burned. PED is expressed as the net calorific value of energy demand from non-renewable resources (e.g. petroleum, natural gas, etc.). Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are considered.

Water Eutrophication - When an overabundance of nutrients is added to a water ecosystem, eutrophication occurs. Nitrogen and phosphorous from waste water and agricultural fertilizers causes an overabundance of algae to bloom, which then depletes the water of oxygen and results in the death of both plant and animal life. This impact is typically measured in either kg **phosphate equivalent (PO_4) or kg nitrogen (N) equivalent.**



Life Cycle Assessment (LCA) - This is a method to quantitatively assess the environmental impact of a product throughout its entire lifecycle, from the procurement of the raw materials, through the production, distribution, use, disposal and recycling of that product.

Material Financial Impact - This is the financial impact associated with the material only. The mass of the model is multiplied by the financial impact unit (units of currency/units of mass) to calculate the financial impact (in units of currency).

Notes