GOA COLLEGE OF ENGINEERING
FARMAGUDI, GOA
DEPARTMENT OF MECHANICAL ENGINEERING

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DESIGN AND FABRICATION OF MECHANICALLY DRIVEN EFFICIENT COW DUNG COLLECTING SYSTEM

by

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A project submitted
in partial fulfilment of the requirements
for the degree of
Bachelor of Engineering
in
Mechanical Engineering
GOA UNIVERSITY

under the guidance of

Dr. Suraj Rane
Head of Mechanical Department,
Mechanical Department
Goa College of Engineering

CERTIFICATE

This is to certify that the project entitled

"DESIGN AND FABRICATION OF MECHANICALLY DRIVEN EFFICIENT COW DUNG COLLECTING SYSTEM"

submitted by

Rudraksh R. Kanekar	**P.R. No.:201807659**
Cydroy Dias	**P.R. No.:201807654**
Poonit Kerkar	**P.R. No.:201807637**
Deepak Bhanushali	**P.R. No.:201807482**

has been successfully completed in the academic year 2021-2022 as a partial fulfilment of the requirement for the degree of BACHELOR OF ENGINEERING in Mechanical Department, at Goa College of Engineering, Farmagudi.

Internal Examiner
(Dr. Suraj Rane)

External Examiner

Head of Department,
Dr. Suraj Rane,
Professor, Mechanical Dept.

Place: Farmagudi, Ponda, Goa
Date:

PROJECT APPROVAL SHEET

The project entitled

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completed in the year 2021-2022 is approved as a partial fulfilment of the requirements for the degree of **BACHELOR OF ENGINEERING in Mechanical Engineering** and is a record of bonafide work carried out successfully under our guidance.

_____

Project Guide,
Dr. Suraj Rane
Head of Department,
Mechanical Dept.

_____

Head of Department
Dr. Suraj Rane
Professor, Mechanical Dept.

_____

Principal
Dr. Rajesh B. Lohani
Goa College of Engineering

Place: Farmagudi, Ponda, Goa
Date:

Declaration

I/We declare that the project work entitled "Design and Fabrication of Mechanically Driven Efficient Cow Dung Collecting System" submitted to Goa College of Engineering, in partial fulfillment of the requirement for the award of the degree of B.E. in 'Mechanical Engineering is a record of bonafide project work carried out by me/us under the guidance of Dr. Suraj Rane. I/We further declare that the work reported in this project has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Signature of candidate/s
Name of the Candidate

Date

Acknowledgement

The manifestation of this project would have been inevitable if not for the grace of almighty on us in these times of pandemic. We express our sincere gratitude to Dr. Rajesh B.Lohani, for permitting us to undertake this project. We thank our Head of Mechanical Engineering Department, Dr. Suraj Rane, for approving our project and permitting us to take departmental resources. We thank Dr. Suraj Rane, our project guide, for his direction and valuable inputs which led to the successful completion of the project. The constant financial and morale support offered by our parents has been of immense help to us and we would like to express our gratitude towards them as well.

RUDRAKSH R. KANEKAR
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Chapter 1

Introduction

"Cleanliness is next to Godliness" Mahatma Gandhi said these words in the previous century, yet still we witness the lack of a clean environment everywhere we go. This was the backbone idea, the critical problem we wanted to solve when we were first ideating about our project.

Cow dung is a very common junk prevalent on roads and streets. Most of the time it's washed away, and whenever it gets cleaned off, it has to be done manually, using scrapers and buckets. This project aims to reduce the manual labour required to clean off the cow dung significantly, while also promoting collection of cow dung for other processing.

Cow shelters still use primitive techniques and tools to collect cow dung inside the sheds, taking into consideration the large shed area that needs to be cleaned, it becomes a tiring and a very long task. Our cow dung collection machine will be of great benefit for shelter maintenance as it has fast collection and high storage

capabilities.

Chapter 2

Problem Statement

2.1 Literature Review

Before the design phase of the collection mechanism assembly, a liitle insight into already existing similar mechanisms were looked upon. There was one research paper of an electrically powered cow dung collecting machine.

Animal Cow dung Cleaner[1]. This is a portable cow dung cleaning machine which has electrically powered conveyor belt which takes collected cow dung from the ground to the bin at rear. This machine is very heavy as it has batteries and a motor, and needs to be built with heavier materials to sustain it's own weight.

Automated Customized Cow Shed Cleaning Machine[2]. This is an entire shed wise cleaning mechanism which cleans cow dung from the shed floor by the means of wipers linked to rails. This system can easily clean an entire area at a very high

speed and efficiency. While it is efficient it's very costly to maintain and is not portable.

2.2 Problem Definition

Cow dung is a viscous, dense and smelly substance. In the current scenario, it is being collected manually which is tedious and time consuming. Cow shelters have to spend 2-3 hours cleaning one shed, and it adds up as the number of sheds increase. Also, cow dung on streets is never cleaned nor collected for the reason being it's too tedious. Cow dung can be used to generate energy via biogas plants, yet a lot of it is always wasted due to the above mentioned reasons.

2.3 Scope of Work

Survey the current collection capacity of cow dung in cow shelters

Design and analyse individual components

Fabricate working model

Chapter 3

Mechanical Components of the Machine

3.1 CAD Model

Figure 3.1: Final 3D CAD model

3.2 Main Frame

It is the supporting structure of the machine on which the other various components are mounted. It should be strong enough to withstand the dead weight of all the components as well as the forces which will be transmitted during operation.

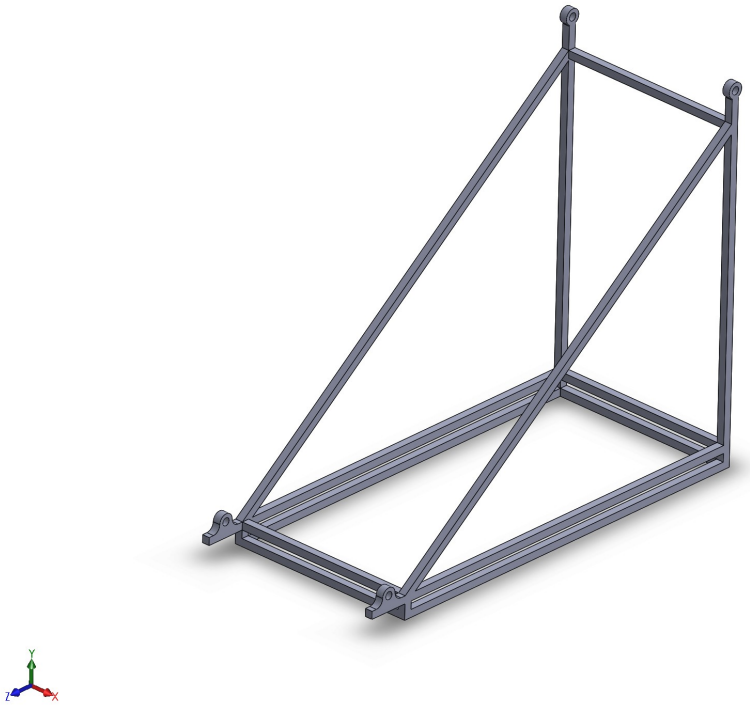


Figure 3.2: Main Framel

3.3 Front Scraper

The front scraper is the initial point of contact for the cow dung. The front scraper will be used to scrape the cow dung off the ground. The scraper must be

in close proximity with the ground surface at all times, it is one of the vulnerable components of the machine, as such it must be durable enough to withstand the head on impact with the stationary cow dung.

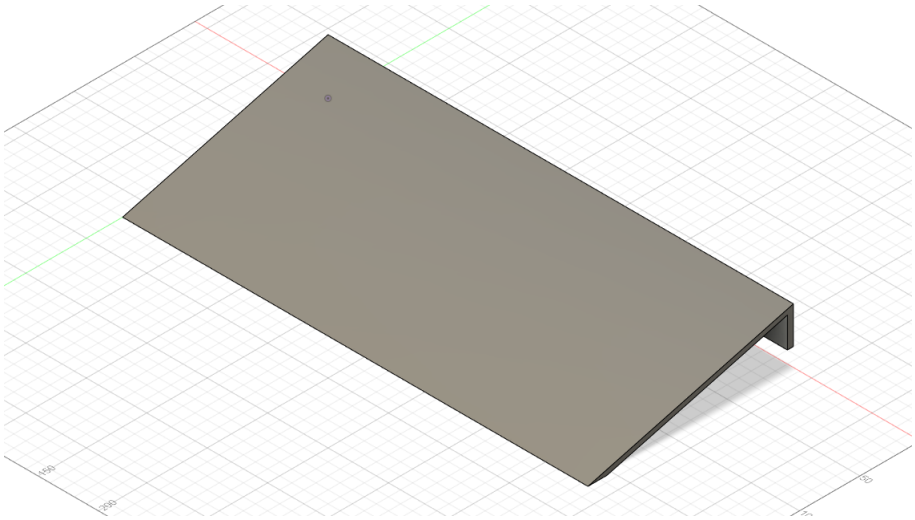


Figure 3.3: Front scraper

3.4 Bottom Plate

The bottom plate is one of the crucial components in evenly distributing the load of the entire machine. The bottom plate will be fixated on the main frame. It will have a small opening for the cow dung that will be collected to be dumped into the storage compartment.

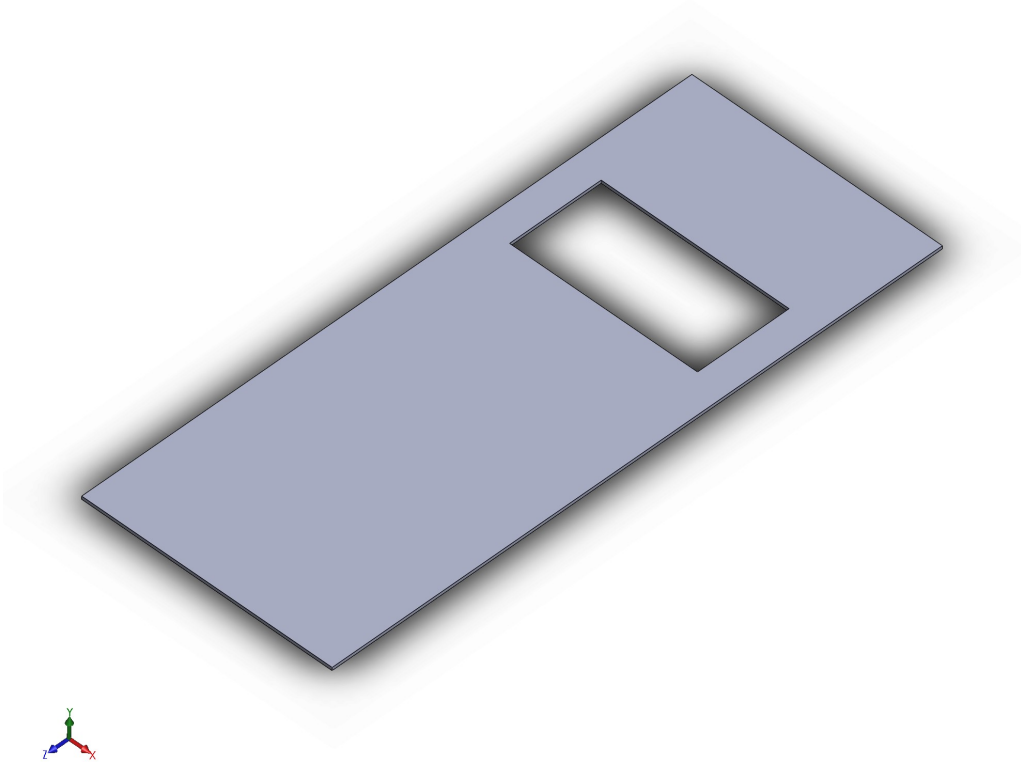


Figure 3.4: Bottom Plate

3.5 Blades on Mount Assembly

3.5.1 Blades

The blades will be in continuous motion so as to convey the cow dung from the front scraper to the storage compartment. A mount will be used to link the blades to the belt in motion.

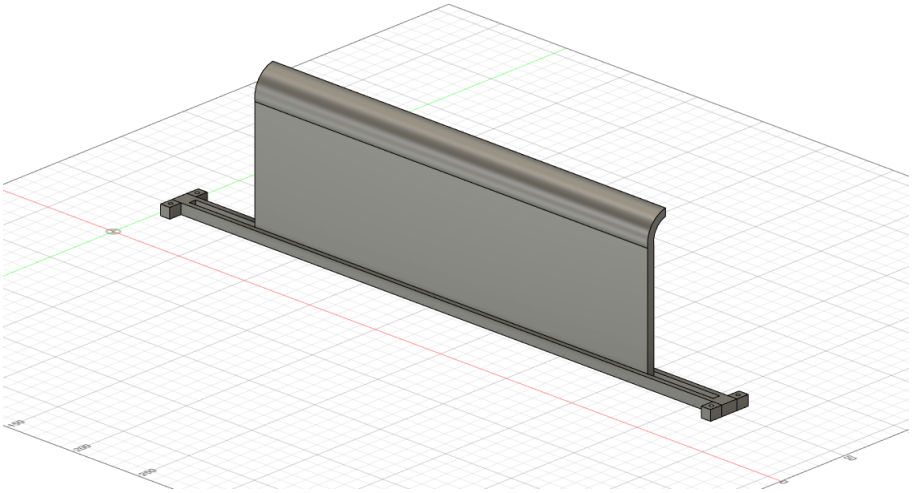


Figure 3.5: Blades

3.5.2 Mount

The mount must be sturdy and robust to sustain the continuous torsional shear stress which is externally applied due to the friction between the cow dung, blade and the bottom plate.

3.6 Belt

The belt is the carrying medium of a conveyor system . A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium-the conveyor belt-that rotates about them. One or both of the pulleys are powered, moving the belt and the mounted blades on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley.

Figure 3.6: Mount

3.7 Shaft

A drive shaft, driving shaft, propeller shaft is a mechanical component for transmitting torque and rotation usually used to connect other components of a drive train that cannot be connected because of distance or the need to allow for relative movement between them.

Figure 3.7: Belt

3.8 Freewheel

In mechanical or automotive engineering, a freewheel or overrunning clutch is a device in a transmission that disengages the driveshaft from the driven shaft when the driven shaft rotates faster than the driveshaft. This is needed to ensure the belt assembly has it's motion constrained in one particular direction.

Figure 3.8: Freewheel

3.9 Bearing

A bearing is a machine element that constrains relative motion between moving parts to only the desired motion. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts.

3.10 Sprocket

It is a profiled wheel with teeth or cogs that mesh with a chain, track or other perforated or indented material. The name sprocket applies generally to any wheel upon which are radial projections that engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed togther directly, and differs from a pulley in that sprocets are never meshed together directly, and differs from a pulley in that sprockets have teeth while pulleys are smooth.

Figure 3.9: Sprocket

3.11 Chain

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

3.12 Tyres

Tyres are designed to support the weight of the machine, transmit torque and traction, and maintain and change the direction of travel.

Figure 3.10: Front and rear tyres.

Chapter 4

Principle of Operation

4.1 Chain Drive

Front wheels are fixed to the shaft for direct power transmission. The shaft is connected to freewheels are the end points. Sprockets are fixed on the driving roller of the belt and attached to the freewheels by chains. The front wheels when pushed forward transmit power to the driving roller via the chain and stop transmitting when the direction is reversed.

4.2 Belt Scraping assembly

Blades which are mounted on the moving belt shall move over the scraper collecting the dung. With each moving blade the the dung will be pushed up against

the gravity on the bottom plate. Dung shall be drop down into the storage compartment once it reaches a particular elevation.

Chapter 5

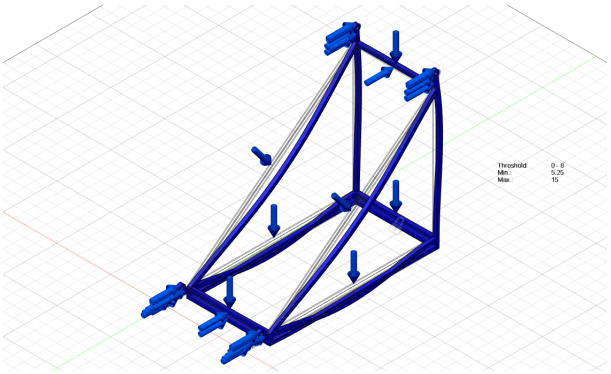
Design and Analysis

5.1 Main Frame

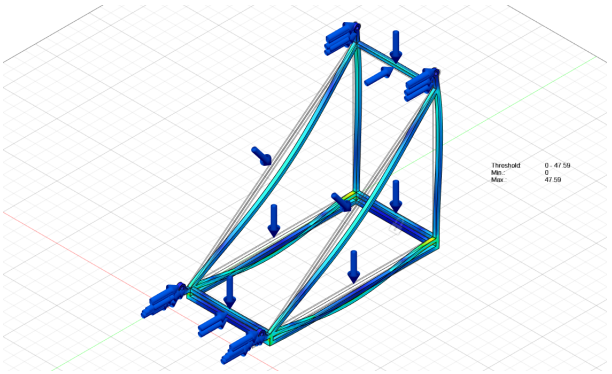
The frame is designed to bear a total weight of 65 kg. The materials taken into consideration were Steel, Aluminium and Stainless Steel based on material selection criteria's such as performance requirements, material reliability, safety, physical attributes, environmental conditions, availability, disposability, recyclability and economic factors. The material required had to be corrosion resistant, light weight and economic. Simulation for all three materials were carried out and stainless steel was selected.

Main Frame									
Material	Safety Factor			Stress (MPa)			Displacement		
	Threshold	Min	Max	Threshold	Min	Max	Threshold	Min	Max
Steel	0-8	4.35	15	0-47.59	0	47.59	0-0.7278	0	0.7278
Aluminium	0-8	5.8	15	0-47.38	0	47.38	0-2.216	0	2.216
Stainless Steel	0-8	5.25	15	0-47.49	0	47.49	0-0.7919	0	0.7919

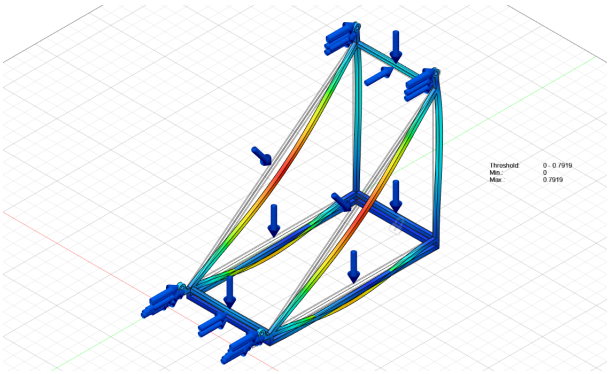
Table 5.1: Stress and Displacement Analysis of Main Frame



(a) Main Frame Safety Factor



(b) Main Frame Stress Distribution



(c) Main Frame Displacement

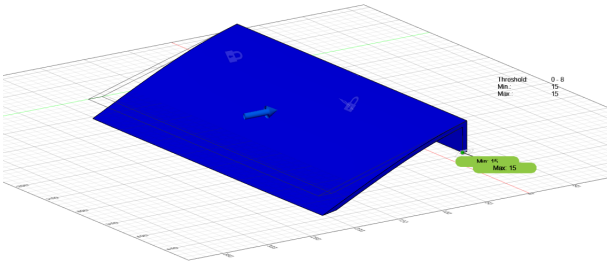
Figure 5.1: Main Frame simulation analysis

5.2 Front Scraper

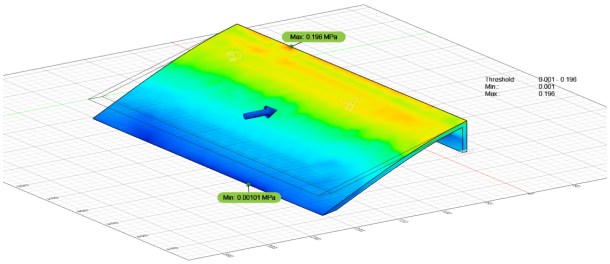
The front scraper is designed to scrape off cow dung from the ground and push it over to the bottom plate. The scraper must be sturdy enough that it can sustain prolonged shear stress due to friction and flexible enough that it can be forced to be as close to the ground as possible without premature plastic deformation. Flexible PVC material is chosen for its durability and flexibility, and it's low weight. Stainless steel also was analysed, the results are shown in the table.

Front Scraper									
Material	Safety Factor			Stress (MPa)			Displacement		
	Threshold	Min	Max	Threshold	Min	Max	Threshold	Min	Max
PVC Flexible	0-8	15	15	0-0.2106	0	0.2106	0-115.3	0	115.3
Stainless Steel	0-8	15	15	0-0.2186	0	0.2186	0-0.0044	0	0.0044

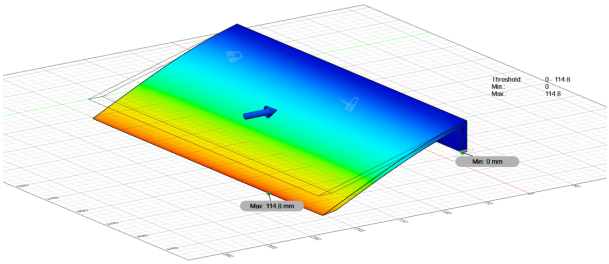
Table 5.2: Stress and Displacement Analysis of Front Scraper



(a) Front Scraper Safety Factor



(b) Front Scraper Stress Distribution



(c) Front Scraper Displacement

Figure 5.2: Front Scraper simulation analysis

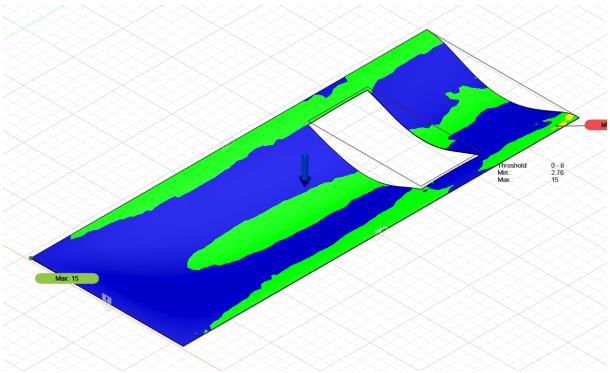
5.3 Bottom Plate

Bottom Plate for the cow dung to be slid onwards to the storage bin. It must be designed to withstand normal stress due to the weight of cow dung and shear stress due to the friction between cow dung and the plates surface when it's being pushed onwards into the storage bin. The bottom plate must have high corrosive resistance. Stainless Steel is preferred material to fabricate this plate due to it's high corrosion resistance. Aluminum is also analysed but not preferred due to its

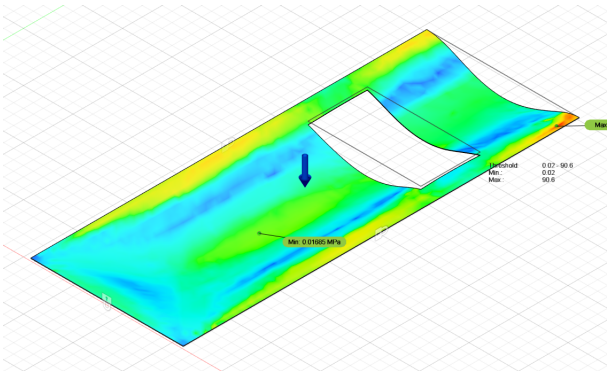
high cost.

Bottom Plate for Mount									
Material	Safety Factor			Stress (MPa)			Displacement		
	Threshold	Min	Max	Threshold	Min	Max	Threshold	Min	Max
Stainless Steel	0-8	2.76	15	0-90.6	0	90.6	0-4.687	0	4.687
Aluminium	0-8	3.11	15	0-88.4	0	88.4	0-12.81	0	12.81

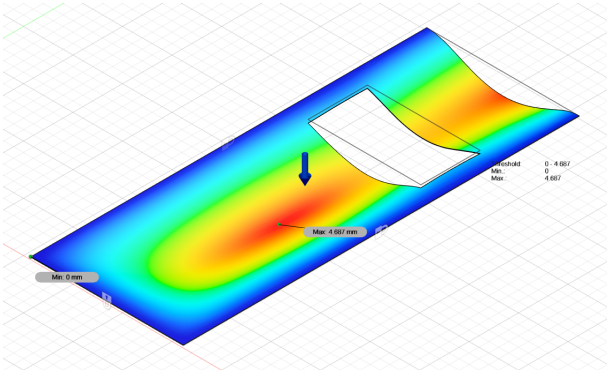
Table 5.3: Stress and Displacement analysis of Bottom Plate



(a) Bottom plate Safety Factor



(b) Bottom Plate Stress Distribution



(c) Bottom Plate Displacement

Figure 5.3: Bottom Mount simulation analysis

5.4 Blades and Mount Assembly

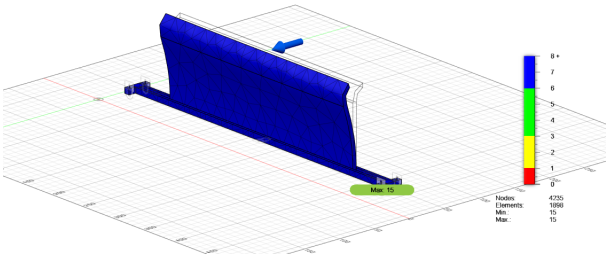
The blades do the job of collecting the cow dung from the front scraper and dumping it in the storage compartment. For this the materials which were taken into consideration for the design of the blades, which would be placed on a mount on the cow dung collector were Steel, Rubber Silicone and Flexible PVC, which were chosen based on the material selection criteria that we had decided.

Out of these materials, on performing simulation we found that having the blades made out of Steel would be most suitable for our mechanism to be efficient, and long lasting.

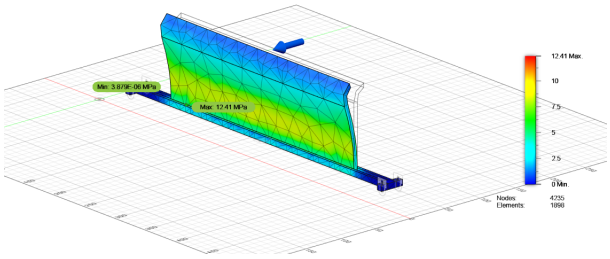
The mount on which the blades would be will also be made out of Steel.

Front Scraper									
Material	Safety Factor			Stress (MPa)			Displacement		
	Threshold	Min	Max	Threshold	Min	Max	Threshold	Min	Max
Steel	0-8	15	15	0-12.41	0	12.41	0-0.0608	0	0.0608
Rubber Silicone	0-8	0.39	15	0-534.4	0	534.4	0-2340	0	2340
PVC Flexible	0-8	1.33	15	0-155.8	0	155.8	0-1296	0	1296

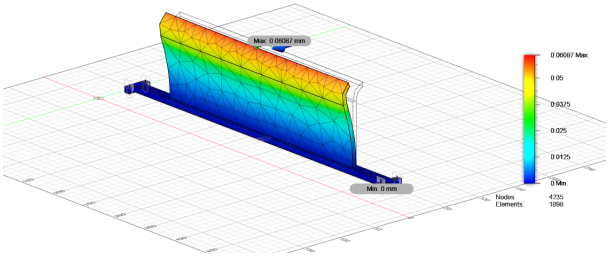
Table 5.4: Stress and Displacement Analysis of Blades and Mount Assembly



(a) Blades on Mount Assembly Safety Factor



(b) Blades on Mount Assembly Stress Distribution



(c) Blades on Mount Assembly Displacement

Figure 5.4: Blades on Mount Assembly simulation analysis

List of Publications

1Md.Manazir, "Animal Cow dung Cleaner", International Journal of Recent Engineering Science (IJRES), ISSN: 2349-7157, volume 3 Issue 5 September to October 2016

Hemanth Kumar R, "Automated Customized Cow Shed Cleaning Machine", IJSRD - International Journal for Scientific Research Development, ISSN (online): 2321-0613

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