VISVESVARAYA TECHNOLOGICAL UNIVERSITY
JnanaSangama, Belagavi – 590018

A Project Report on

"SOLAR ENERGY BASED AUTOMATIC DRAINAGE CLEANING MACHINE"

Carried out by

SAGAR.M.N	1KS16ME425
SHIVA KUMAR.R.M	1KS16ME427
TIPPESH.M	1KS16ME432
VINAY KUMAR	1KS16ME436

Submitted in partial fulfillment for the award of
BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING

Under the Guidance Of
Mr. MURULIDHAR.K.S
Assistant Professor
Department of Mechanical Engineering

K.S. GROUP OF INSTITUTIONS
KSIT

DEPARTMENT OF MECHANICAL ENGINEERING
K S INSTITUTE OF TECHNOLOGY
Bengaluru – 560109
2018-19

K S INSTITUTE OF TECHNOLOGY

Bengaluru – 560109

DEPARTMENT OF MECHANICAL ENGINEERING

CERTIFICATE

This is to certify that the project work entitled **"SOLAR ENERGY BASED AUTOMATIC DRAINAGE CLEANING MACHINE"** is a bonafide work carried out by

Name	USN
SAGAR.M.N	**1KS16ME425**
SHIVA KUMAR.R.M	**1KS16ME427**
TIPPESH.M	**1KS16ME432**
VINAY KUMAR	**1KS16ME436**

In partial fulfillment for the award of **Bachelor of Engineering** in **Mechanical Engineering** from**Visvesvaraya Technological University**, Belagavi during the academic year 2018-2019. It is certified that all the corrections/suggestions indicated for the internal assessment have been incorporated in the report deposited in the department. The project has been approved as it satisfies the academic requirements.

Signature of Guide	Signature of HOD	Signature of Principal/Director
Mr.MURULIDHAR.K.S	**Prof.Umashankar M**	**Dr. T.V Govindaraju**

EXTERNAL VIVA

Name of Examiners	Signature with Date
1. M. Umashankar	12/6/19
2. Dr. H.R. Vitala	12/6/19

K S INSTITUTE OF TECHNOLOGY

Bengaluru – 560109

DEPARTMENT OF MECHANICAL ENGINEERING

DECLARATION

We Sagar.M.N, Shiva Kumar.R.M, Tippesh,M, Vinay Kumar students of 8th semester B.E, Mechanical Engineering, K.S. Institute of Technology, Bengaluru hereby declare that the project report entitled "**SOLAR ENERGY BASED AUTOMATIC DRAINAGE CLEANING MACHINE**" embodies the record of the project work carried out by us, for the fulfillment of the course requirement for the award of Degree in Bachelor of Engineering in Mechanical Engineering, Visvesvaraya Technology University, Belagavi during the academic year 2018-2019. Further, the matter embodied in dissertation has not been submitted previously by anybody for the award of any Degree or Diploma to any other University.

Signature of the candidates

1.
2.
3.
4.

Place: Bengaluru

Date: 10/06/19

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The success of this project depends largely on the encouragement of many individuals who have guided us through this. We take this opportunity to express our gratitude to those who have been instrumental in the successful completion of this project.

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CONTENTS

List of Figures

LIST OF TABLES

ABSTRACT

When we talk about the water that is on Earth, the surface of the earth is covered with about 71% water and the water present in the ocean is approximately 97% of the total water present on the earth .While the remaining 3% of the water is in the form of ice, in the rivers, in the lakes, in the soil and in all living organisms. The water supply of our planet is continuously from one place to another, from one form to another, through the water cycle. The water of oceans is not potable due to being salted. Only 3% water is potable in which 2.4% water is present in the glaciers, northern and southern poles in the form of ice. Remaining 0.6% water is present in the rivers, ponds and lakes which can be. In such way controlling of wastes of water and water pollution must our primary purpose.

This project is about replacing the manual work in drainage cleaning by automation plays a vital role in all industrial applications. Yet, the proper disposal of sewage from industries is still a challenging task. Drainage pipes are been used for the disposal and unfortunately sometimes there may be loss of human life while cleaning the blockage in the drainage pipes. In order to overcome the problems in manual drain cleaning, we are implementing "SOLAR ENERGY BASED AUTOMATIC DRAIN CLEANING MACHINE", to clean and control the drainage level.

CHAPTER 1

INTRODUCTION

1.1. Significance of Water

Water is being used very fast in today. The significance of water is mainly used for cooking, cleaning and drinking in our lifestyle. The water used in the factory and the house comes from the drains and reaches in the rivers, in the ponds and in the oceans. In which more solid ingredients (polythene, bottles etc) along with water also reaches. We have built automatic drain cleaning machine with the main purpose of removing these solid materials from drains. This machine can be established at any point of drain very easily. It has been design in such a way that its lets water flow through it but collects all the solid substances and gives a group in the dustbin. This machine is able to do cleaning and moving process together on the drains/gutters.

1.2. History of Drainage Systems

- Historically, urban drainage systems have been viewed with various perspectives. During different time periods and in different locations, urban drainage has been considered a vital natural resource, a convenient cleansing mechanism, an efficient waste transport medium, a flooding concern, a nuisance waste water, and a transmitter of disease. In general, climate, topography, geology, scientific knowledge, engineering and construction capabilities, societal values, religious beliefs, and other factors have influenced the local perspective of urban drainage. For as long as humans have been constructing cities these factors have guided and constrained the development of urban drainage solutions. Historical accounts provide glimpses of many interesting and unique urban drainage techniques. This paper will highlight several of these techniques dating from as early as 3000 BC to as recently as the twentieth century. For each example discussed the overriding perspective of urban drainage for that particular time and place is identified. The following are some of well-known historical drainage.

Fig.1.1 Historical drainage at France

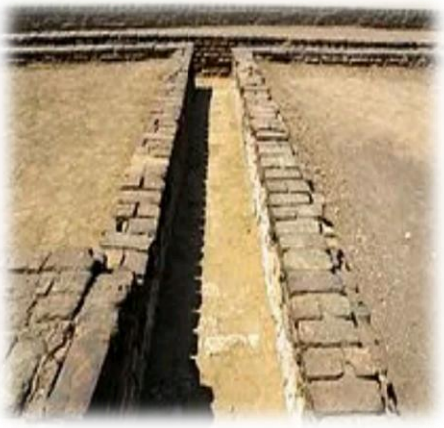

Fig.1.2Historical Tank Stream, Sydney

1.3. Relating Modern Engineering with Ancient Technologies

The relation of modern engineering to ancient engineering is difficult to comprehend considering that modern engineering is so highly specialized and technologically advanced. Design rules-of thumb, empirical equations, physics, numerical methods, computer simulators, and other engineering tools taken for granted today were not available to ancient engineers. Despite the supreme technological advantage today's engineer has over the ancient engineer, fantastic engineering feats rivaling those of today were achieved throughout history. For example, several ancient civilizations built magnificent cities of stone, brick, and wood and equipped the cities with sophisticated infrastructure systems including roads, water supply and distribution systems, waste water collection, and storm water drainage. Further, in some instances infrastructure systems were integrated, as was often the case with waste water collection and storm water drainage.

- Urban drainage in the early parts of the twentieth century was firmly established as a vital public works system. Engineers continued to improve design concepts and methods. During the second half of the twentieth century regulatory elements were promulgated in the United States, Europe, and other locations addressing urban drainage issues. Extensive monitoring efforts vastly improved the understanding of urban drainage quantity and quality characteristics. Computer modelling tools advanced the methods used to design and analyse urban drainage systems. Regulations, monitoring, computer modelling, and environmental concerns have altered the perspective of urban drainage from a public health and nuisance flooding concern during the first half of the twentieth century into a public health

and nuisance flooding with additional concerns for ecosystem protection and urban sustainability.

1.4. Methods to design and construct sustainable urban drainage systems

These are currently being researched and tested. Alternative development concepts (e.g., low-impact development) are influencing development practices to minimize the impacts of development on storm water drainage. In addition, alternative on-site waste water management strategies are being touted as more sustainable than centralized waste water management for some situations. Communities are searching for innovative techniques to capture, detain, and use rainwater within the watershed instead of constructing massive drainage structures. Many communities are developing watershed-wide storm water quality management plans to meet the dual objectives of flood prevention and water quality control. Urban drainage has indeed expanded significantly during the past few decades beyond a technical challenge to drain the urban area expeditiously to include the consideration of social, economic, political, environmental, and regulatory factors.

- Summary in this paper we reviewed chronologically several urban drainage systems from 3000 BC to present. From this review three points stand out:

  The general public and city administrators viewed urban drainage systems as a convenient waste disposal system, an important flood control system, the cause or transmitter of disease, a vital system for the protection of public health, an underground refuge for criminals and undesirables, and a source of civic pride.

  • The purposes of urban drainage systems, including flood control, waste transport, and water collection and recycling, often evolved through trial-and-error modifications after the systems were initially constructed.

  • Changes in perspective of urban drainage in one city were most often caused by disease outbreaks, scientific discoveries, or technical advances in planning, design, and construction.

- On such sewage control system, a project "Automated Drainage Cleaning System by Solar Energy" has been developed. One of the greatest disadvantages of present drainage cleaning system is irregular cleaning and maintenance of drainage systems. This results in unsafe healthy environment and more water logging occurs and disturbs the transportation system.

  With all the above consideration a newly developed project is carried out successfully. In this project a drive mechanism has been developed to collect waste

and segregate the waste in the waste bin. A chain drive mechanism which runs by the solar energy is used to lift the waste and to dump it into a flat belt conveyor. This conveyor moves the waste into the waste bin. The solar panels are arranged in a hit like structure above the top, which provide the driving power for motors

The development of this project is simple manufacture and assembly. Various concepts were generated to meet the requirement of the problem. These evaluated according to the need or requirement and the modular design concept, which was obeyed by many, was developed. The detail design and optimization was carried out by using the solid modelling software.

This project is worked by the principal of chain drive mechanism system, which uses inclined drive mechanism to lift the load. One third of it is immersed in the drain and the remaining is kept open to trap solar power.

- By this type of drainage cleaning system installation/ setup we can reduce human interference and cleaning maintenance, and increase the efficiency of drainage system.

  This model was manufactured at Lynus Automation, Bengaluru. This project was also exhibited at an exhibition titled "Engineering Fair-2016" held at Visvesvaraya Industrial and Technological Museum, Bengaluru. It was well appreciated by the inmates, and the public people who visited the museum.

  Hoping that, this project leads the current drainage systems. It is also felt that there would be a radical change in the drainage cleaning systems.

CHAPTER 2

LITERATURE REVIEW

2.1. Back Ground

Fig.2.1 Human involvement in drainage cleaning

Fig.2.2 Human removing waste slurry manually

Before the late 1800s, the general means of disposing human excrement was the outdoor privy while the major proportion of the population used to go for open defecation. Sewage treatment systems were introduced in cities after Louis Pasteur and other scientists showed that sewage born bacteria were responsible for many infectious diseases.

Akio Got and Kazuyuki Yamasaki in their journal "a new waste water treatment technology for mixed acid drainage containing fluorine"[1], describes that The Early attempts, in the 900s, at treating sewage usually consisted of acquiring large farms and spreading the sewage over the land, where it decayed under the action of micro-organisms. It was soon found that the land became 'sick'. Later attempts included the discharge of waste water directly into the water bodies, but it resulted in significant deterioration of the water quality of such bodies.

In general, from about 1900 to the early 1970s treatment objectives were concerned with: -

1. The removal of suspended and floatable material from waste water.
2. The treatment of biodegradable organics (BOD removal).

The CWA requires that municipal waste water treatment plant discharges meet a minimum of 'Secondary treatment'. Over 30 percent of the waste water treatment facilities today produce cleaner discharges by providing even greater levels of treatment than secondary.

CHAPTER 3

PROBLEM DEFINITION

Urbanization disrupts natural drainage patterns, natural watercourses are destroyed, natural retention of runoff by plants and soil is removed and the creation of impervious surfaces increases the amount of runoff. This runoff becomes polluted as solid waste, silt and contaminants are washed off roads, leading to water logging and creating adverse social, physical, economical as well as environmental impacts. When manually clean the gutters then it cause health issues to them.

Based on the analysis of data collected, by various resources the problem was defined "To Develop and Fabricate Automated Drainage Cleaning System which is run by Solar Energy, used to keep the Drainage System Clean and Free from Health Issues". The Drainage Cleaning System is of Simple Mechanism which is run by Solar Energy. It should be Portable, Easy to Carry, Easy to Manufacture, Easy to Assemble in Development and it should be Cost Effective.

3.1 Parameters to be incorporated:

- Maintenance free.
- Should use less power or no power.
- High efficiency and reliability.
- Sufficient enough to carry calculated amount of waste.

These are the some of the requirements or the common needs to the drainage cleaning system installation according to the survey. By analysing the above data collected, the following observations were made-

3.2 Observations:

- There is a need to have a developed version and instrumentation of automated drainage cleaning system.
- This should use less power or it should develop its own power requirements.

3.3 Key for the success of model:

- It should be automated.
- It should clean efficiently.
- Installation of the model should have a good strength with a lower cost.

CHAPTER 4

METHODOLOGY

In order to develop an automated drainage cleaning system by the use of solar energy, several concepts were first studied before selecting the best final concept. The following are the various concept generations done while selecting the project concept on the drainage cleaning system topic.

Fig. 4.1 Proposed working methodology of the system

4.1. Process involved

- If we turn on motor switch or if we supply current to the motor the motor starts to rotate.
- The rotary motion of the shaft is connected to the top shaft by chain and sprockets which is placed on horizontal shaft.
- From top shaft that motion is transferred to the bottom shaft by using sprockets and chains.
- Buckets which are used for lifting waste from drainage is placed or attached between two chains which are on top and bottom shafts.
- The dust bin which is used for collecting all the waste is placed behind the chains.
- When we switch on the motor the two shafts starts to rotate. Thus the buckets also starts move.
- The buckets enters into water while rotating when it is coming up it also lift the waste present on the water along with it.
- It carries the wasted along with it and finally dumps that waste in dust bin during rotation.

CHAPTER 5

EXPERIMENTAL WORK

5.1. Concept Generation

Concept generation aims to design principles if the new product. These should be sufficient to satisfy the requirements and differentiate the concept from other existing conceptual projects. Specially, the new concept design should show how it will deliver its core of benefit.

There are two simple secrets to successful concept generation. Firstly, generate lots of concepts and secondly select the best concept.

After deep study of problems faced by the existing conceptual project, a new concept is identified based on the problem. Then the product study is done. There are some customer requirements, which are considered to be very important.

The following are the concepts generated for the development of **Automated Drainage Cleaning System by Solar Energy.**

- Concept 1. vertical belt driven mechanism
- Concept 2. inclined flat belt drive mechanism
- Concept 3. inclined chain drive with screw conveyor
- Concept 4. inclined belt drive mechanism with flat conveyor
- Concept 5. chain drive mechanism with conveyor and solar panels

5.1.1 CONCEPT1: VERTICAL BELT DRIVEN MECHANISM

Here the belt is used to run over the pulleys, where elevated buckets were used on the belt, practically it was very difficult to fit over the belt, and moreover belt is made of leather or cloth or rubber, which is having its own problem under the water.

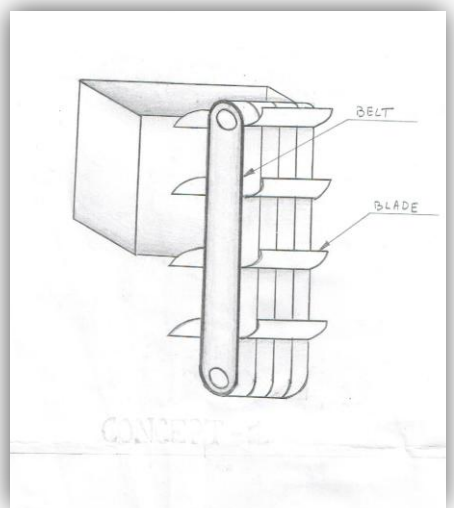

Fig.5.1Vertical belt driven mechanism

In this concept the belt is moved over a pulley, since the belt is under the water there is a chance to slip, creep, which leads to slackening because of this the major power loss will occur. The buckets or blades which carry floating wastages may get thrust because of water which will not pass through the profile.

Table 5.1 Advantages and disadvantages of vertical belt drive.

Advantages	Disadvantages
• Easy to construct.	• Efficient cleaning is not done.
• Simple arrangement.	• Vertical arrangement will result in improvement of waste.
• Maintenance is easy.	

CONCEPT 2: INCLINED FLAT BELT DRIVE MECHANISM

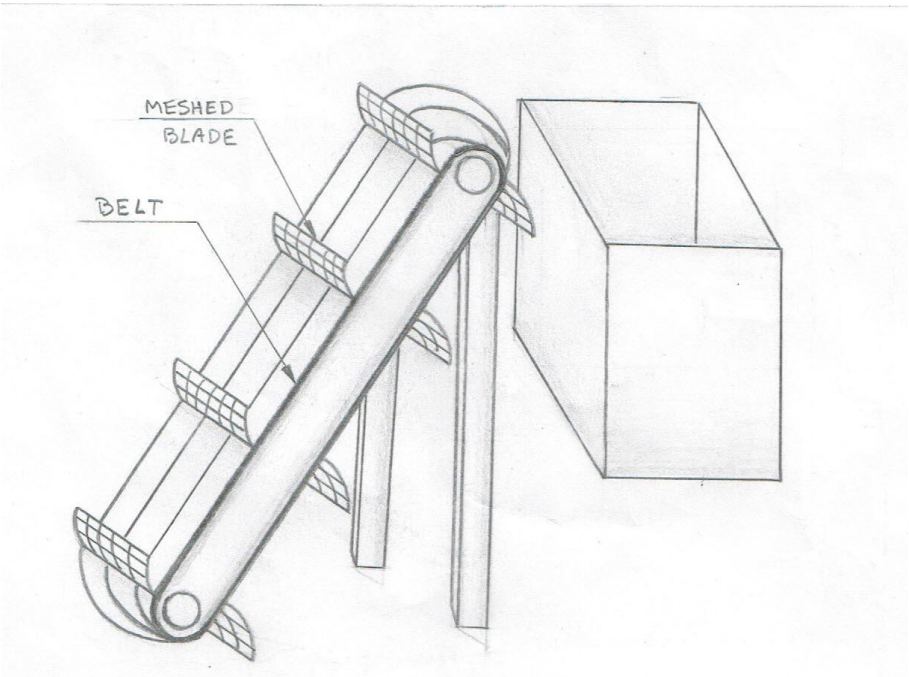

Fig.5.2 Inclined flat belt drive mechanism

In this concept the belt drive is inclined at an angle of 60^0 from its base. The waste bucket is placed slightly below the top end of the drive. This inclination provides the minimum load on the shafts further reduces the power requirements of the motors.

Table 5.2 Advantages and Disadvantages of inclined belt drive mechanism

Advantages	Disadvantages
• Less resultant load on the shafts.	• No further improvement in its slipping problem.
• Increased efficiency of drive	• There is no further development to accommodate more waste.
	• There is no facility for the disposal of collected waste

CONCEPT 3: INCLINED CHAIN DRIVE WITH SCREW CONVEYOR

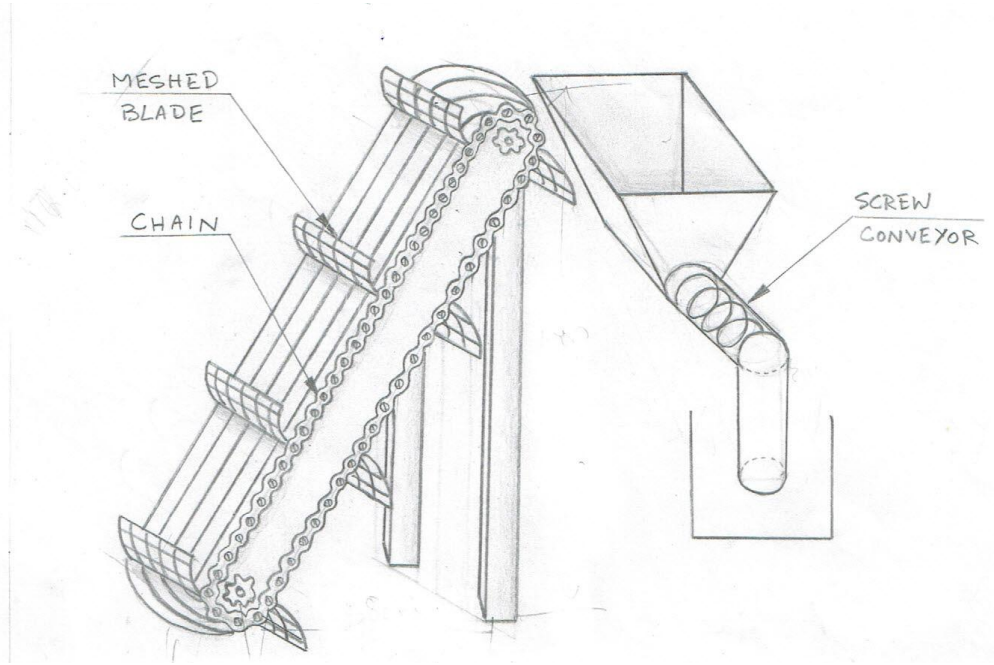

Fig.5.3 Inclined chain drive with screw conveyor

This is the developed version of the previous model or concept. Here the waste box is attached to a screw conveyor as shown in above figure. Here the belt drive mechanism is replaced by the chain drive, because this will not slip. The chains and sprockets were coated with corrosion resistant material so as to protect against rusting. The screw conveyor draws out the waste collected and dumps it to the container provided at the land surface.

Table 5.3 Advantages and disadvantages of inclined chain drive with screw conveyor

Advantages	Disadvantages
• Slip is found as in case of belts	• Problems with less pitch length of screw conveyor.
• More space for waste collection.	• Bigger items may stuck in the screw conveyor.
• Blades can be easily accommodated on drive.	• Due to non-meshing of blades with box considerable waste are dropped.

CONCEPT 4: INCLINED BELT DRIVE MECHANISM WITH WASTE COLLECTOR

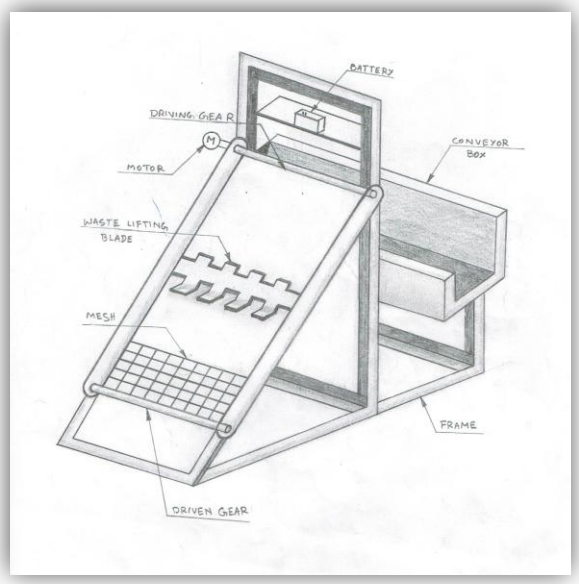

Fig.5.4 Inclined belt drive mechanism with waste collector

We have made used of blades with holes drilled in it, which drains out the water from being lifted by the blades and it carries only light floating wastes which leads to blogging of drainage system.

Table 5.4 Advantages and Disadvantages of inclined belt drive with waste collector.

Advantages	Disadvantages
• Less resultant load on the driving shaft.	• Requires external power source
• Flat conveyor has very good compatibility to carry larger weights.	• Not that much efficient
• The wired mesh facilitates to segregate the waste at one place.	

CONCEPT 5: CHAIN DRIVE MECHANISM WITH WASTE COLLECTOR AND SOLAR PANELS

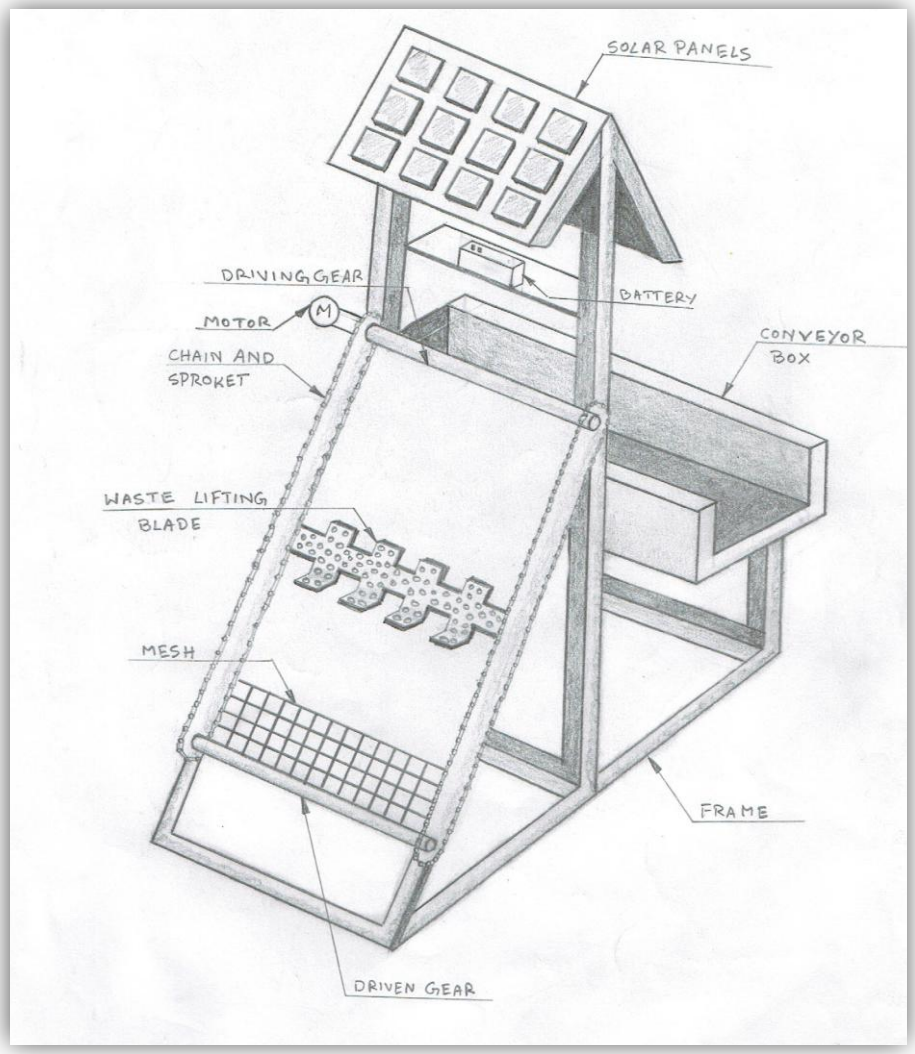

Fig.5.5 Chain Drive Mechanism with Waste Collector and Solar Panels

In this concept, the chain drive is moved over a pulley, since the belt is under the water there is a chance to slip, creep, which leads to slackening because of this the major power loss will occur. In the first concept the floating wastage can be carried up to certain height while the blade starts moving down the dumping of the carried wastage leads to problem because there is no provision to collect wastage.

Table 5.5 Advantages and Disadvantages of chain drive mechanism with waste collector and solar panels

Advantages	Disadvantages
• Effective use of solar energy	• Subjected to intensity of sun light.
• It produces its own power	
• Uninterrupted working using direct and charged power.	
• Becomes cheaper while done in mass production	
• Recycled materials can be re used here.	

5.2. Concept Selection

Considering the above observations of all three concepts we select the third concept for the development and fabrication of automated drainage cleaning system.

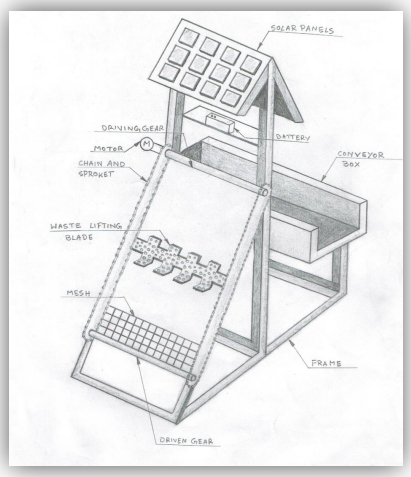

Fig.5.6 Detailed parts of selected model

The various concepts were generated and analysed by their own merits and demerits. All these merits and demerits played an important role in selection of the best among the various concepts. Keeping the main aim of development of drainage cleaning system.

Considering all the three concepts with their respective merits and demerits, one best concept is selected. The one of it is the concept no.5 inclined chain driven mechanism with solar panels. The following are the reasons for the selection of the concept.

Reasons for the selection of the concept:

- Efficient waste management can be achieved .
- We can achieve automation using minimum requirements.
- It uses minimum power and need less maintenance.

Finally, it is said that **the concept no.5 i.e. inclined chain driven mechanism with solar panels** is selected as the best among the entire three concepts. And it is finalized to be developed as the project concept.

CHAPER 6

DESIGN AND FABRICATION

6.1. Development of Individual Components by Solid Modelling Software

This project development has been designed to obtain an automated drainage cleaning system. This is made by some mechanism such as chain and sprocket mechanism for transmitting the drive force to moving blades, flat belt conveyor mechanism for segregating the waste at one place. The structure of stand is made of L-shaped mild steel with the thickness of 5mm. this development consists of many material and parts labelled below by the figure.

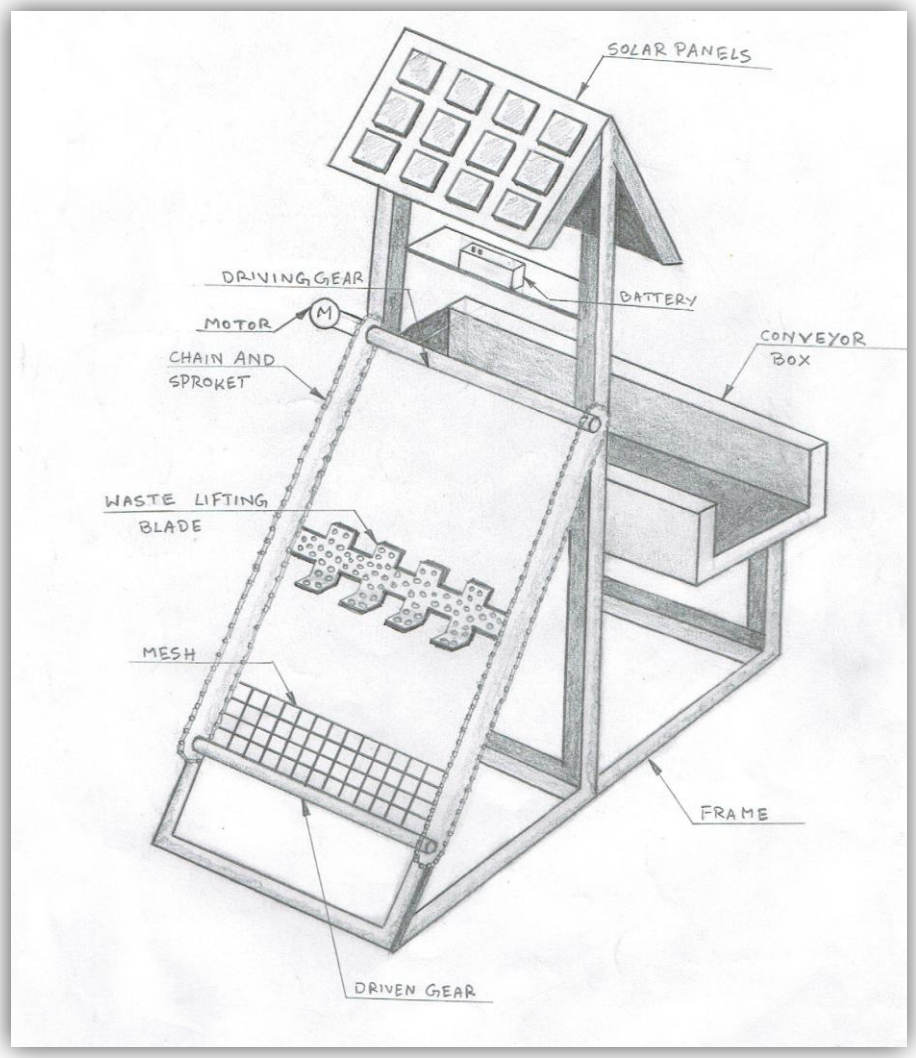

Fig.6.1 Development of components by solid modelling software

The following are the design and the description of each part of the model. A brief detail is given about the part for its working principles and other factors influencing the part.

Frame Structure of a body: Figure6.2 shows 3D Model of Frame work of Structure of a body. The skeleton is made with an arrangement to have the conveyor box on its rear end and the chain drive mechanism in its front. The height of the model is about 110cm to accommodate the drive mechanism.

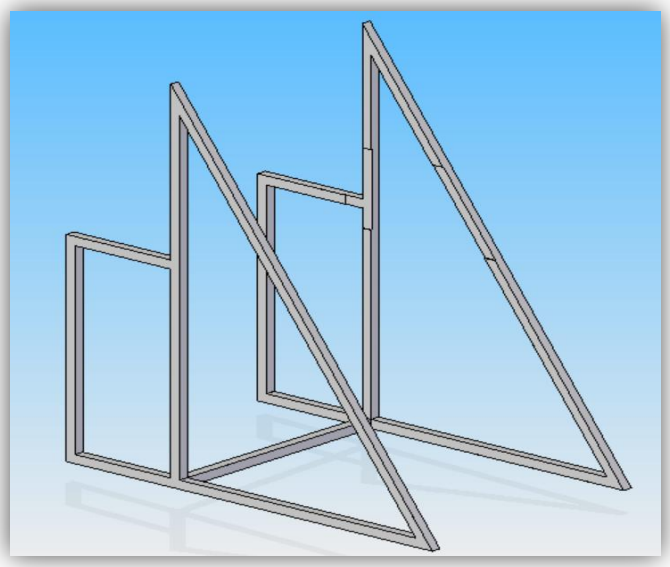

Fig 6.2 3D Model of Frame work of Structure of a body

The above skeletal body is developed are per the calculated dimensions. This body rigidly holds both chain drive mechanism as well as conveyor box. It is done as per the standard drain dimensions.

- **Waste Collector:** This is the Waste collector box used to drain out the waste and to segregate it into the waste bin at its open end. It is made in such a way that its projected parts mesh with the moving blades carrying the waste, hence forth without distracting the motion of blades.

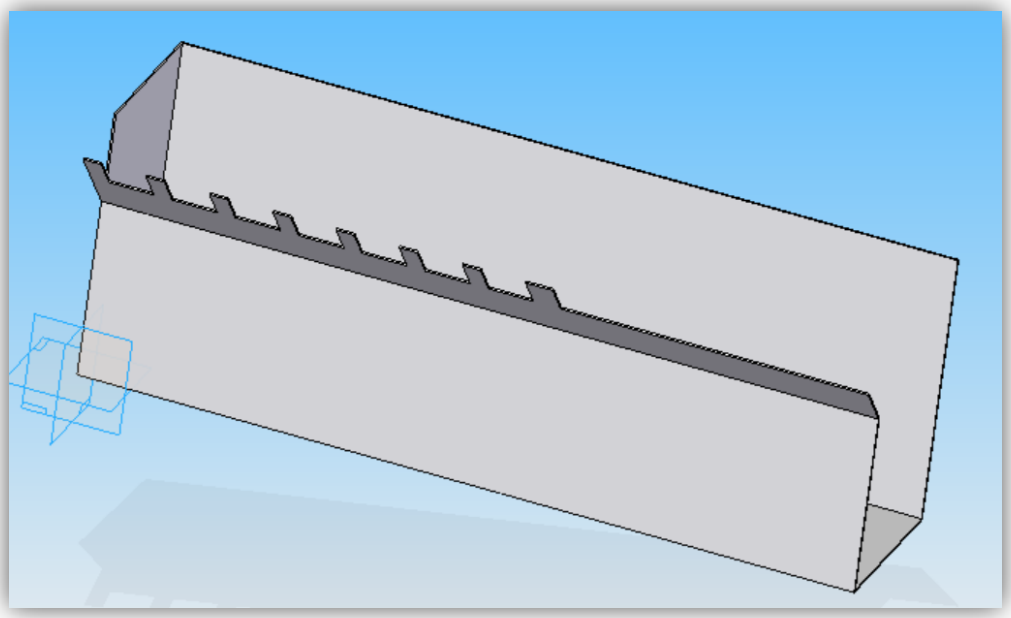

Fig 6.3 3D Model of Waste Collector Box Used To Drain Out the Waste

- **Solar panel stand:** The stand as shown in fig.6.4 is used to place the solar panels at its upper most surface of the model, which is made of cast iron and welded according to the required shape and size. It is made in such a shape, so that it can hold the solar panels at opposite positions. it also advantageous to draw the maximum intensity of sun light during both morning and evening.

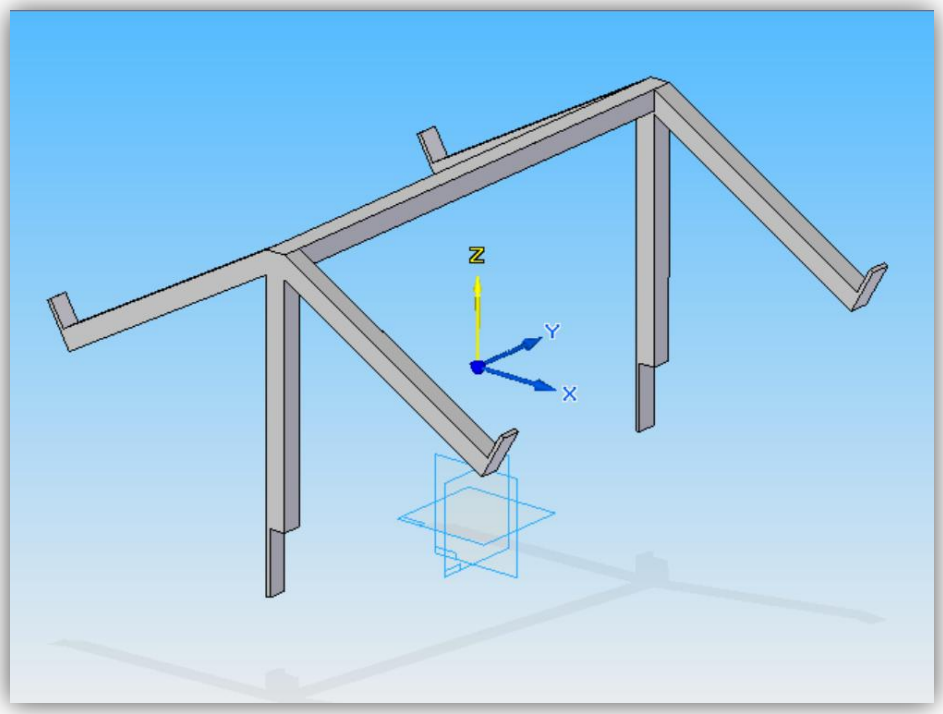

Fig 6.4. 3D Model frame To Fix Solar Panels

- **Plummer blocks:** Plummer blocks are used to fix the shafts parallel to each other. They support the shafts and withstand the vibrations produced during transmission of torque. They maintain the constant centre distance between both the driven and driving shafts.

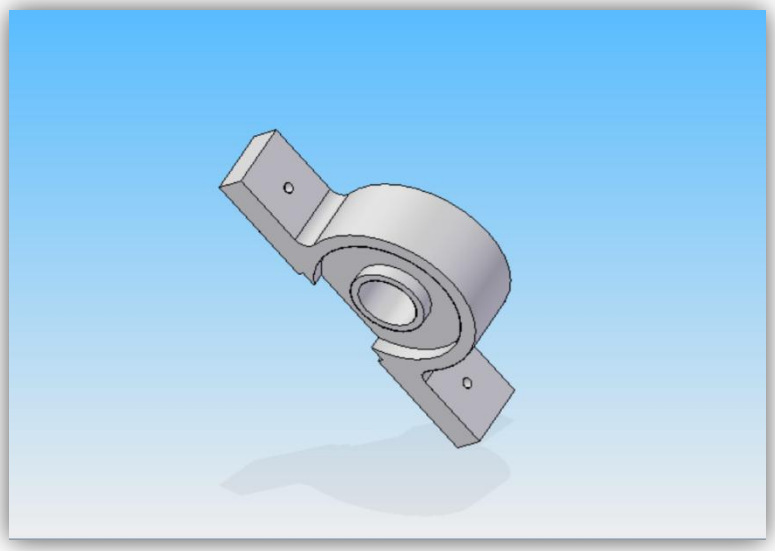

Fig 6.5 3D Model of Bearing housing block

- **Shaft:** A mild steel solid shaft of length 75cm is used to accommodate the drive mechanism on it. it also withstands the load of the waste carried by the blades. Two shafts of same diameter are used for the drive. The driving shaft is quite longer than the driven shaft as it is coupled with the driving motor.

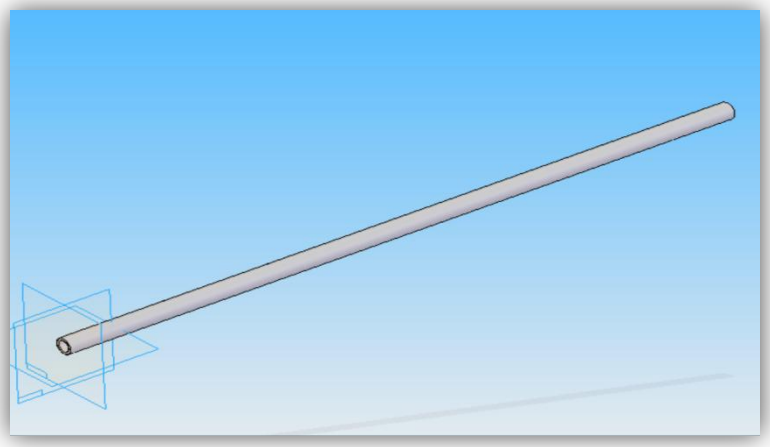

Fig 6.6 3D Model of Shaft which connects Sprockets

- **Solar panels:** A couple of solar panels are used to generate the power required to drive the motors. We selected solar energy because it is inexhaustible and pollution free and also easily available. The capacity of each solar panel used is 24V, 35Wand 2.5A, which is sufficient to drive the motor.

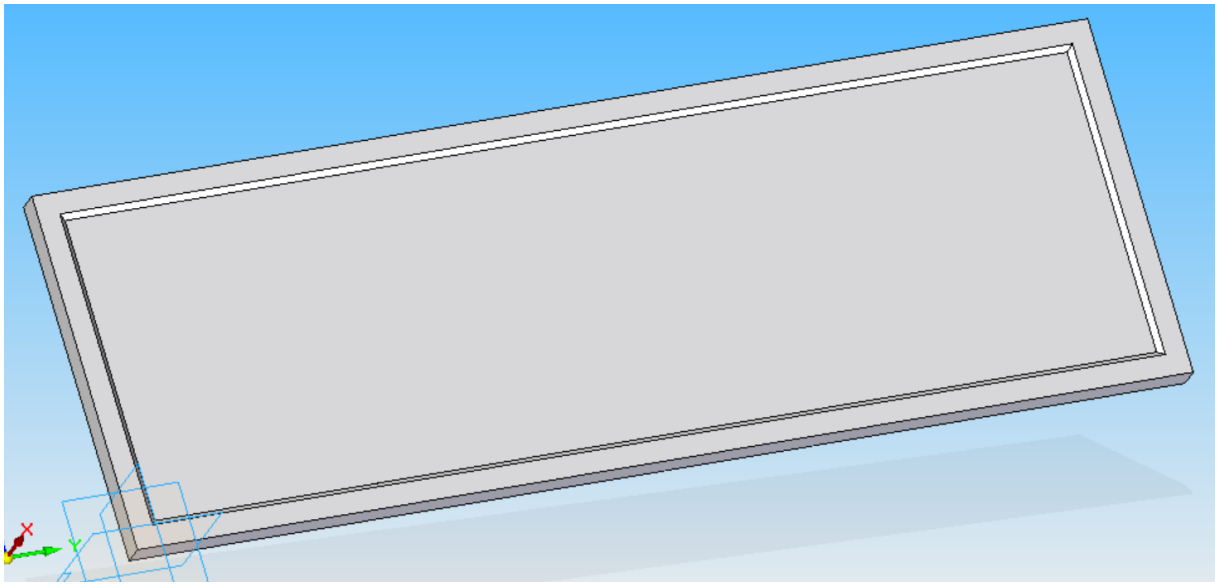

Fig6.7 3D Model Of Solar Panel

- **Sprockets:** Sprockets are used with chain to transmit torque to blades from the motor. They also maintain the tightness of the chain

Fig 6.8 3D Model Of Sprocket

6.2 PARTS USED

- **Muff coupling**: Figure6.9 shows muff coupling. This is used to couple the motor shaft with that of the driving shaft by the screws provided in the muff coupling.

Fig.6.9 Muff Coupling

- **Shafts:** Figure6.10 shows mild steel shaft. Two mild steel shafts were used for the chain drive mechanism. Among these driving shaft is if length 75cm and that of driven shaft is of 65mm.

Fig.6.10 Mild Steel Shafts

Plummer block: Figure6.11shows Plummer block. Plummer blocks were used to support the drive mechanism and to maintain constant centre distances.

Fig.6.11 Plummer block

- **Sprocket:** Figure6.12 shows sprocket used in chain drive.

  They facilitate the easy working of lift mechanism.

Fig.6.12 Sprocket Used In Chain Drive.

- **Motors:** Figure 6.13 shows D.C. motor

These are the main drivers for both chain drive and the belt drive mechanisms.

Two motor of rating 21V, 35W. Both these motors were connected in parallel connection with the battery.

Fig. 6.13 D. C. Motor

- **Chain:** Figure 6.14 shows chain used in chain drive. These chains were used to facilitate the movement of the blades. The blades are welded to this chains arranged parallel side by on the steel shafts.

Fig.6.14 Chain

- **Blades:** Figure 6.15 shows metal buckets used to lift waste.

  The blades of the below form were used to carry the wastes from the drain. These blades were further drilled with holes in them to reduce weight of the blade.

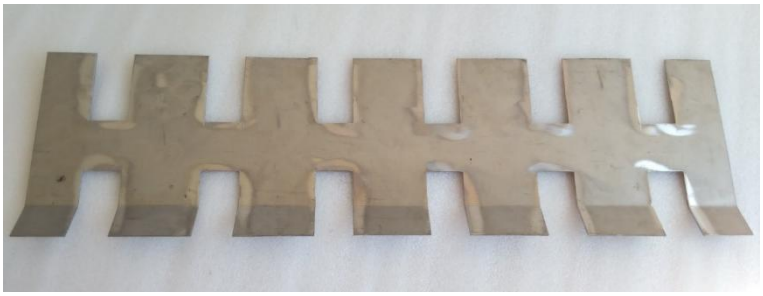

Fig.6.15 Metal Buckets

- **Bearings:** Figure6.16 shows bearings used to support shaft.Bearing is used to support the belt drive shafts with constant centre distances with low co efficient of friction.

Fig.6.16 Bearings

6.3. PART DRAWING

- **Part drawings of frame work of the structure:**

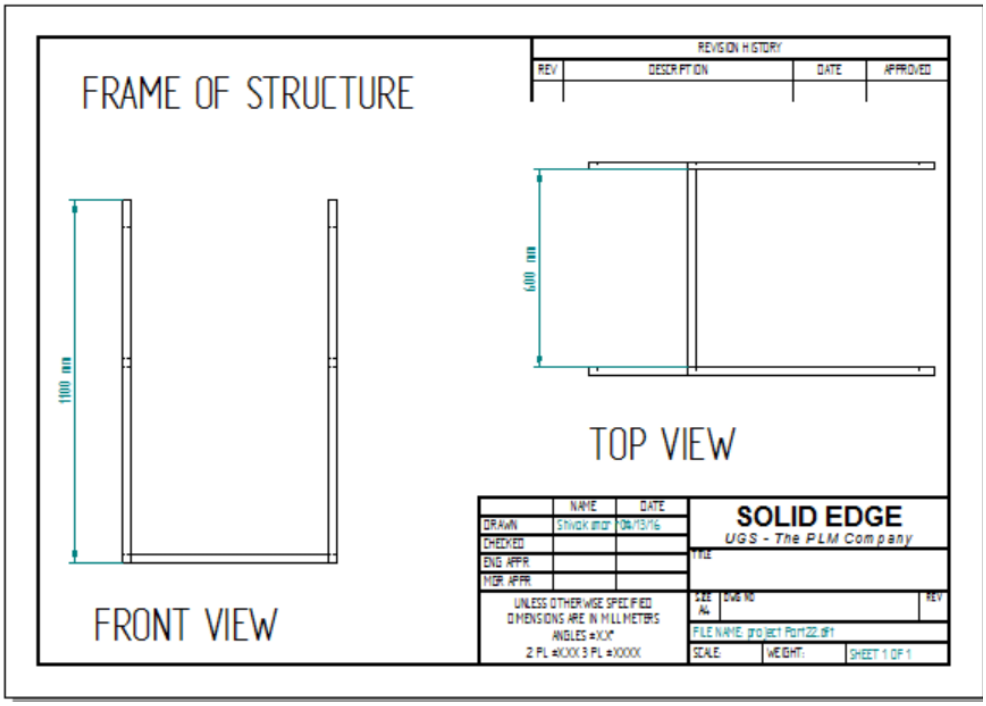

Fig.6.17 Front and Top View of Frame

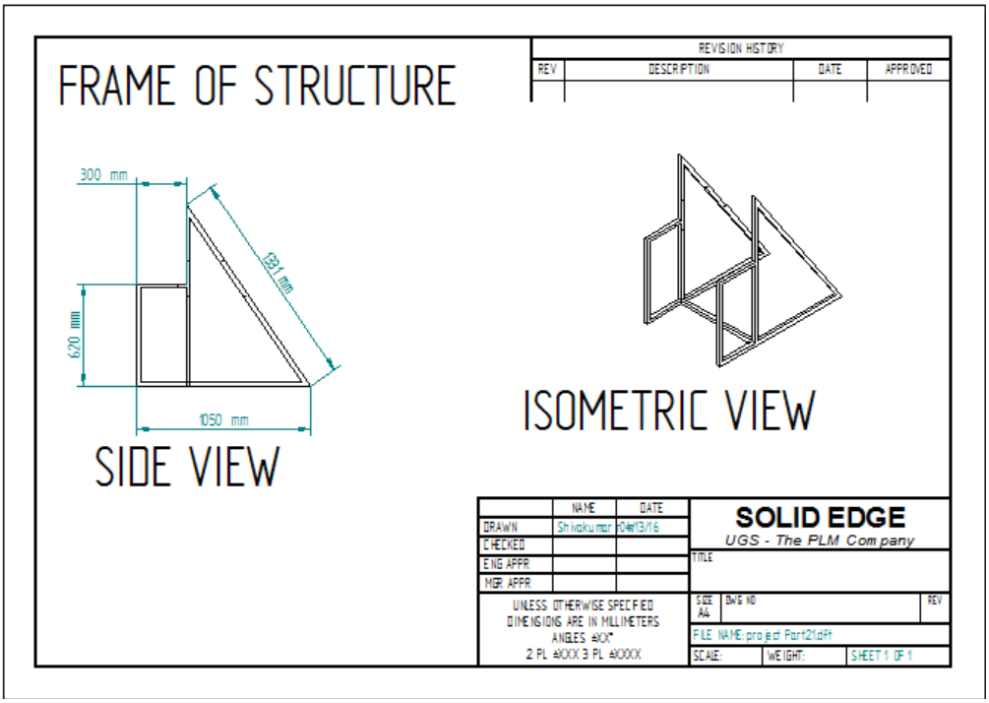

Fig.6.18 Side and Isometric Views of Frame

- **Part drawing of Plummer block:**

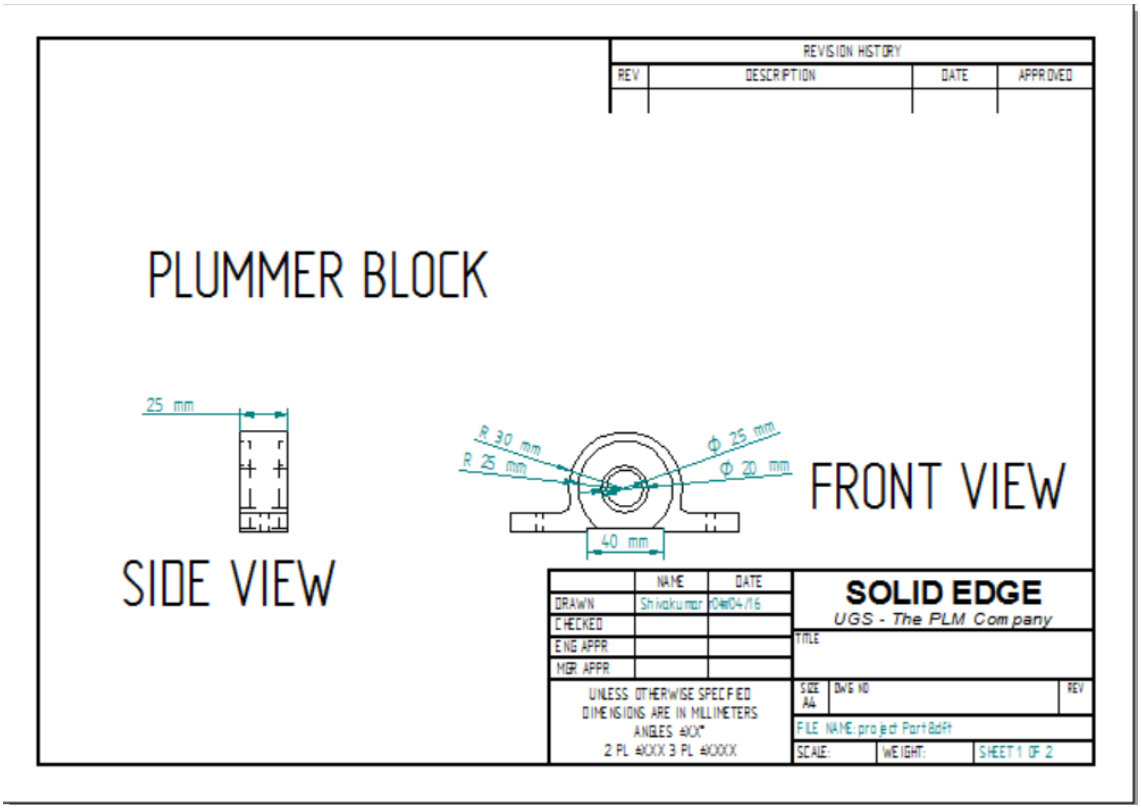

Fig.6.19 Front and Side Views of Plummer Block

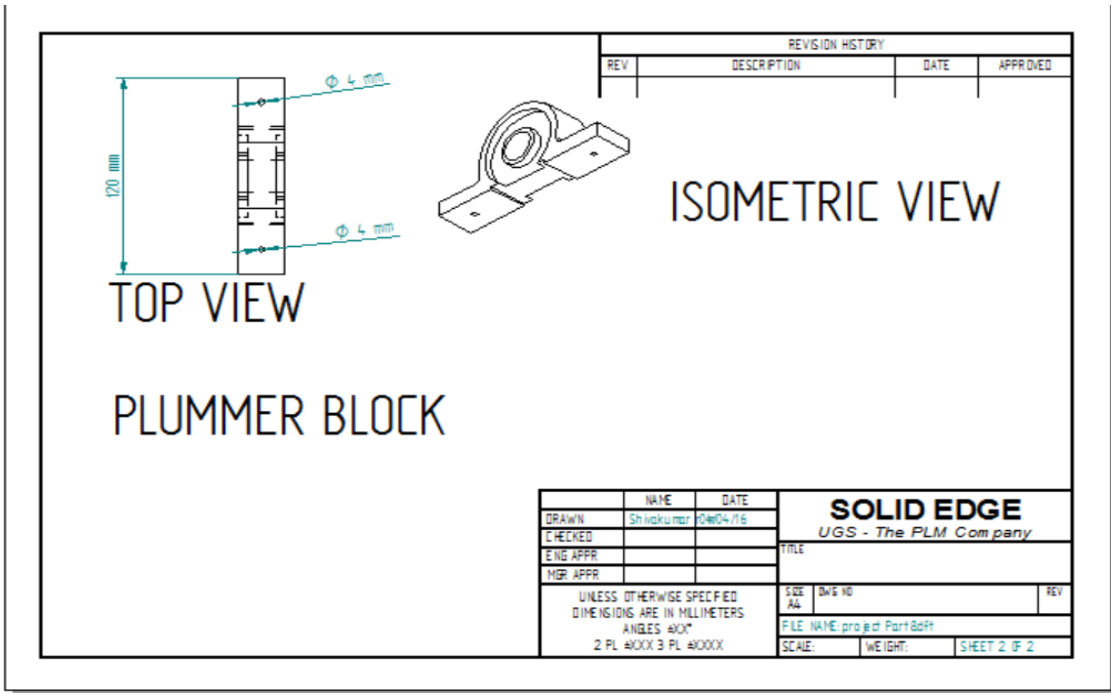

Fig.6.20 Top and isometric views of Plummer block

Part drawing of solar panel board

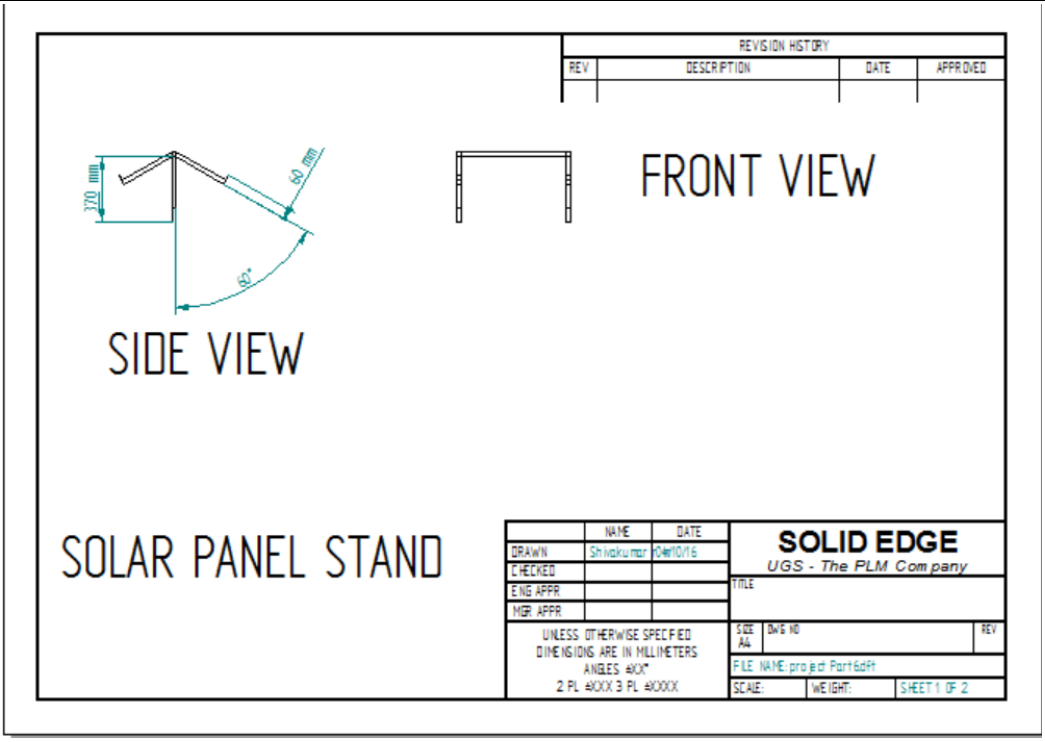

Fig.6.21 Front and side views of solar panel stand

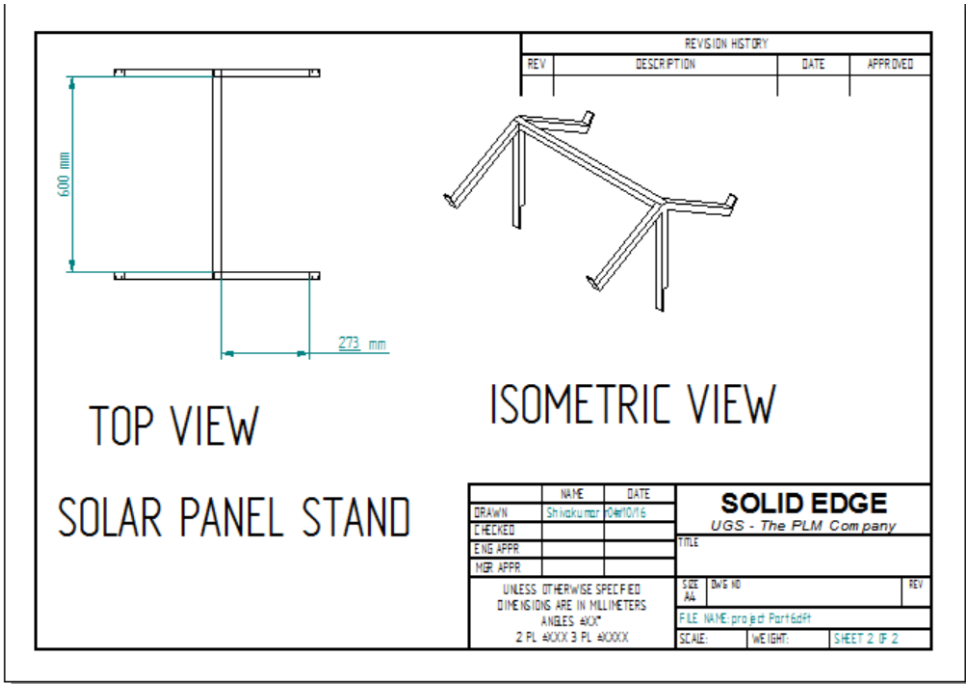

Fig.6.22 Top and isometric views of solar panel stand

- **Part drawings of battery stand**

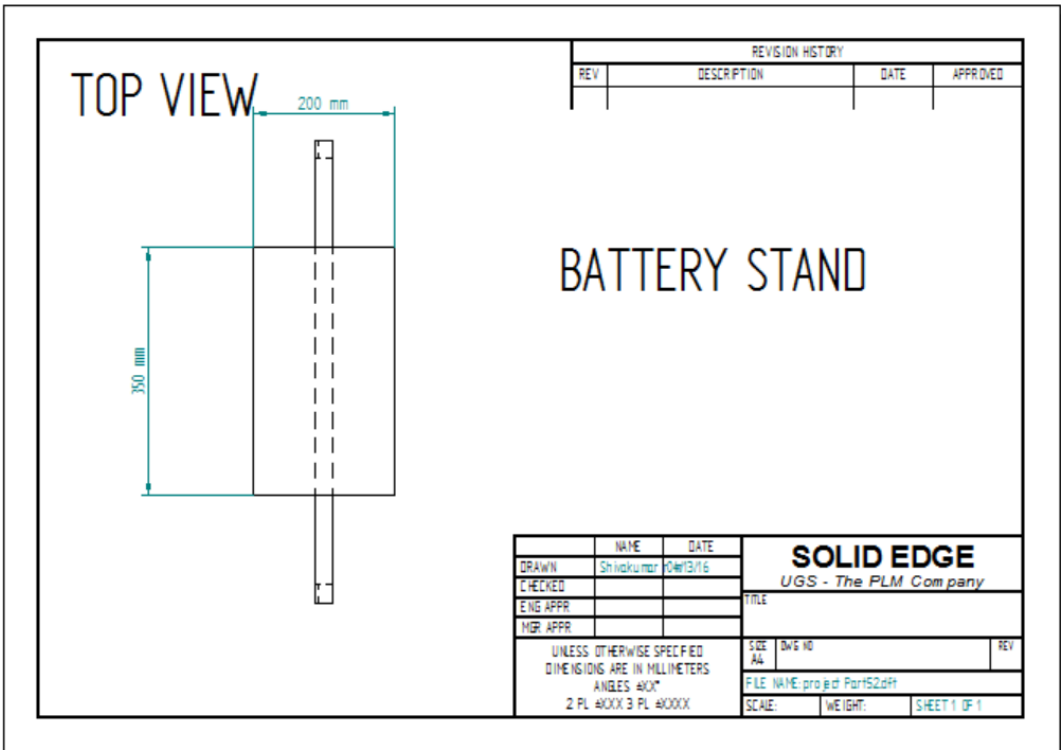

Fig.6.23 Top view of battery stand

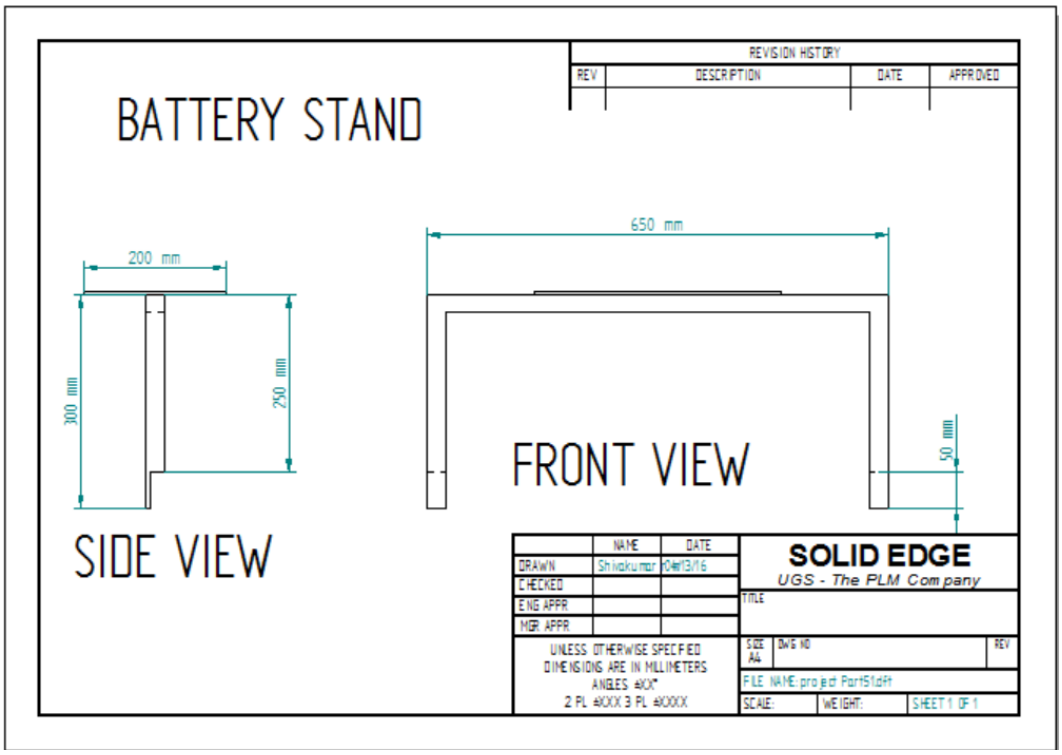

Fig.6.24 Front and side views of battery stand

- **Part drawing of wire mesh:**

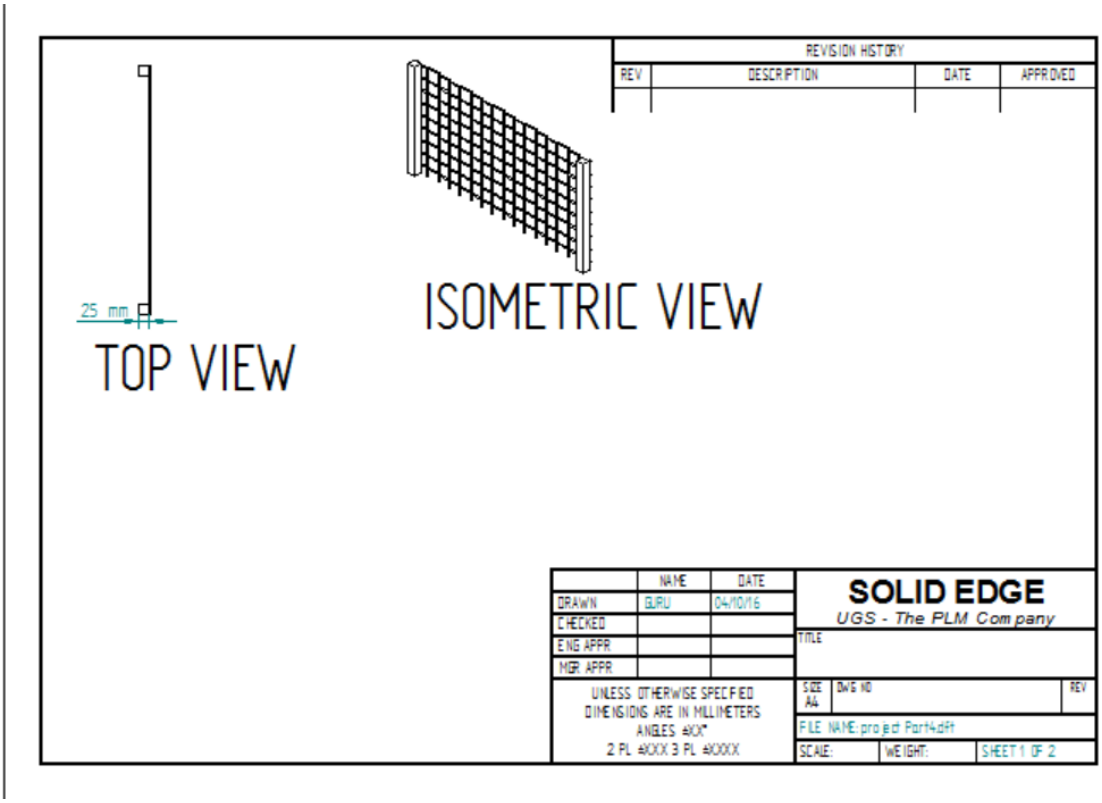

Fig.6.25 Top and isometric views of grilled mesh

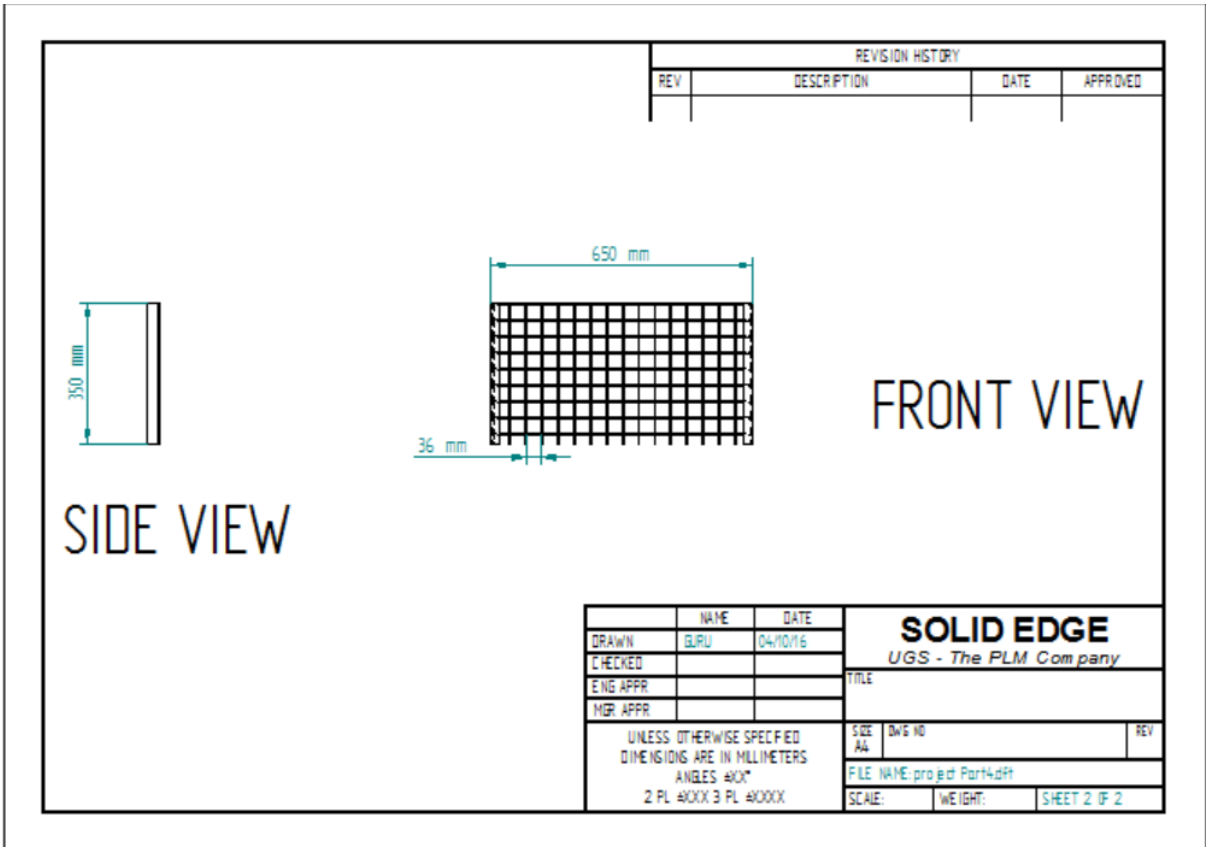

Fig.6.26 Side and front views of grilled mesh

6.4. FABRICATION

In order to prepare the working model of automated drainage cleaning system through solar power, we have used Solar Panels of suitable output voltage capacity as housing above the conveyor box. We have used sheet metal of suitable thickness and strength and machined according to desired shape and used Chain and Sprocket mechanism for transmission of power from motor to rotate the shaft of the model and movements of the conveyor

Figure6.27 shows structural frame of the model.
The skeletal body (frame) has been fabricated by Mild Steel bar as per the dimensions calculated before.

Fig.6.27 Structural Frame

Figure6.28 shows grilled Mesh used to collect waste.
Waste segregator is fabricated with half grilled and half polystyrene sheet.

Fig.6.28 Grilled Mesh

Figure 6.29 shows model attached with metal buckets.

By the use of perforated metal sheet, the weight of blade is reduces, thus increases the load carrying capacity.

Fig.6.29 Perforated Metal Buckets

CHAPTER 7

RESULTS AND DISSCUSSIONS

7.1 Devices currently in use

Following are some of the equipments currently used.

7.1.1. Mechanical Excavators and earth movers

Currently in big channels mechanical excavators as shown in figure are used. These are used to remove the wastes that are sunk under the water level.

Fig.7.1 Mechanical excavators at work

Earth movers removing waste from the local dump yard. These are manual methods which require regular involvement of human beings.

Fig. 7.2 Earth mover removing waste from ground

7.1.2 marine waste removal method

Manual method of removing marine waste by the workers. Since the boat size is small and requires larger shifts to remove whole waste.

Fig. 7.3 Manual method of removal of marine waste

Construction of float barriers accumulates the floating wastes. Since these wastes are not regularly removed, it leads to growth of mosquitoes which is harmful for health.

Fig.7.4 example of float barriers

An experimental canal waste segregator is as shown. This is used to filter waste on canals of irregular shape. This has a drawback that since no enclosure is provided the collected waste may again go back to canal again.

Fig. 7.5 canal waste segregator

7.2 Merits of solar based automatic drainage cleaning machine over all the above current methods

Solar energy based automatic drainage cleaning machine is simple in construction, has minimal components as compared to all the above methods.

Since this don't need any external power supply unlike earth movers, makes it economical.

since the waste can be disposed efficiently, more preferable than canal waste segregator.

Fig.7.6 Solar energy based automatic drainage cleaning machine

7.3 PARTS DESCRIPTION

7.3.1. Description of Chains

In order to design, build and discuss chain drive systems it is necessary to understand the terminology and concepts associated with chain drive systems. Good designers and engineers have experience and knowledge and the ability to communicate their thoughts and ideas clearly with others. The students and teachers who participate in this unit will learn the terms and concepts necessary to design, draw and build chain drive systems, and improve their "Chain Drive literacy".

Chain drives, gear drives and belt drive systems are all effective power transmission choices. Each offers advantages and disadvantages with respect to the other. The advantages of chain drive systems are as follows:

1. Shaft centre distances are relatively unrestricted. Whereas gear drive centre-to-centre distances are restricted to specific dimensions for a given set of gears, the centre distances between two chained sprockets can vary anywhere from 50% to 300% or more of their pitch diameters.
2. Chain Drive are relatively easy to install. Assembly tolerances are not as restrictive as those for gear drives. Chain drives are a better choice for less experienced builders working with a minimum of machine tools.
3. Chain drives can be readily redesigned and reconfigured in comparison to gear drive systems.
4. Chains perform better than gears under shock loading conditions.
5. Chain drives spread operating loads over many teeth whereas the operating loads acting on gear drives are concentrated on one or two teeth.
6. Chain drives do not require tension on the slack side (Belt drives do) thus bearing loading is reduced.
7. Chain drives require less space for a given loading and speed condition than pulleys and belts.
8. Chain drives systems are (usually) less costly to build and maintain than an equivalent gear drive.

7.3.2 Roller Chain Construction

Roller chains are assembled using link plates, pins and rollers and connecting them in an endless chain using a connecting link.

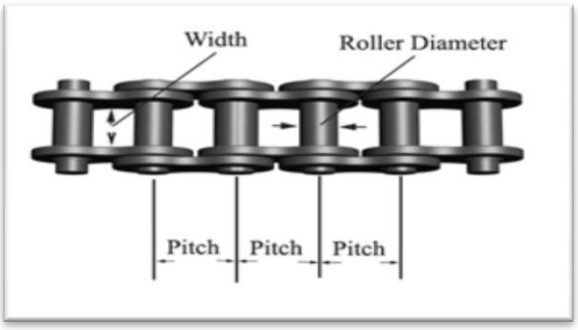

Fig.7.7 Specifications of Roller Chain.

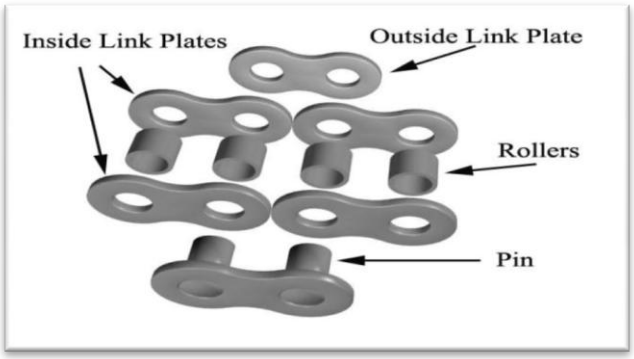

Fig.7.8 Various Parts Of Roller Chain

7.3.3 Parameters for Chain Construction

The following are the parameters to be considered while designing the chains for required transmission of power.

Table 6.1 Parameters for chain construction.

Chain Dimension	Symbol	Pitch Ratio
Roller Diameter	**D_r**	5/8 x Pitch
Chain width	**W**	5/8 x Pitch
Pin Diameter	**P**	2/8×Pitch
Link Plate Thickness	**LPT**	1/8 x Pitch
Roller Link Plate Height	**Hr**	4/8 x Pitch

➢ SPECIFICATIONS OF MODEL

Table 6.2 Following are the specifications of the model

GEAREDMOTOR	**0.08HP,12V.**
SOLAR PANEL	Number of cells=36*2, output voltage=36v
STRUCTURAL MATERIAL	Mild Steel of 5mm thickness
LOAD CAPACITY	up to 0.85KG dynamic load per blade
VOLTAGE REQUIREMENT FOR OPTIMUM LOAD	12V
BATTERY CAPACITY	12V,1.3AH
BATTERY LIFE	5 Hours in optimum load
TIME REQUIRED TO FULLY CHARGE BATTERY	120minutes

➢ OUTPUT CHARACTERS OF SERIES AND PARALLEL COMBINATIONS

Voltage and current output when panels connected in parallel : 18v, 0.72A

Voltage and current output when panels connected in series : 36v, 0.36A

Minimum voltage output of solar panels used : 16v (in parallel)

Average voltage output of solar panels : 24v

Optimum voltage output of solar panels : 32v (in series)

8.1. CONCLUSION

Comprehensive automated drainage cleaning system has been developed for the mentioned short comes in a cost effective manner, which cleans the drainage regularly by just simple mechanisms which is run by Solar Power and requires less human power for maintenance and working.

This report has the development and fabrication of automated drainage cleaning system prototype in its opening stages of research. A prototype was shown to be successful within the given parameters, but further development is required in order to improve upon the progress which was achieved. The conclusions summaries the successful aspects of the system, the areas in need of attention should further research be conducted, and the flaws discovered throughout the duration of the research period. The device is place across drain so that only water flows through lower grids. Waste like bottle, etc. Floating in drain is lifted by teeth which are connected to chain. This chain is attached by gears driven by motor. The energy provided to motor is solar photovoltaic cell connected to it. When motor runs the chain starts to circulate making teeth to lift up. The waste materials are lifted by teeth and are stored in waste storage tank**.**

8.2. SCOPE FOR FUTURE WORK

- An enhanced drainage cleaning system.
- With lights installed can reduce or eliminate street lamps.
- In future it may also be able to accommodate the water treatment facility in it.
- May also accommodate sun tracking tech to improve efficiency.

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