

DESIGN AND DEVELOPMENT OF AN AUTOMATIC DRAINAGE SCRAP CLEANING AND COLLECTING SYSTEM USING CHAIN MECHANISM AND SOLAR ENERGY

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Mechanical engineering.

by

DABBAKUTI THREE VENKATA SIVA NAGA SAI (37150043)
DAREDDY TARUNANANDREDDY (37150044)



;

**DEPARTMENT OF MECHANICAL ENGINEERING
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY) JEPPIAAR NAGAR, RAJIV GANDHI SALAI,

CHENNAI - 600 119

Accredited with Grade "A" by NAAC

MARCH – 2021

DECLARATION

WeDabbakuti.ThreeVenkataSivanaga Sai (37150043) and Dareddy.Tarunanandreddy (37150044) hereby declare that the Project Report entitled “**DESIGNAND DEVELOPMENT OF AN AUTOMATIC DRAINAGESCRAP CLEANING AND COLLECTING SYSTEM USING CHAIN MECHANISM AND SOLAR ENERGY**” done by us under the guidance of **Dr. G.SENTHILKUMAR M.E. Ph.D.atSATHYABAMA Institute Of Science and Technology**, Chennai is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Mechanical engineering

1.

2.

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SATHYABAMA



INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with “A” grade by NAAC

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119

www.sathyabama.ac.in

DEPARTMENT OF MECHANICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafede work of Dareddy.TarunanandReddy (37150044) and Dabbakuti.Three Venkata Siva naga Sai (37150043) who carried out the project entitled “**DESIGN AND DEVELOPMENT OF AN AUTOMATIC DRAINAGESCRAP CLEANING AND COLLECTING SYSTEM USING CHAIN MECHANISM AND SOLAR ENERGY**” under my supervision from August 2020 to March 2021.

Internal Guide

Dr. G. SENTHILKUMAR M.E., PhD.

Head of the Department

Dr. G. ARUNKUMAR, M.E., PhD.,

Submitted for Viva voce Examination held on _____

Internal Examiner

External Examiner

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ABSTRACT

The proposed concept is to replace the manual work in drainage scrap cleaning by automatic drainage scrap cleaning and collecting using chain mechanism and solar energy. Now-a-days even though mechanical drainage plays a vital role in all domestic and industrial applications in the proper disposal of sewages from domestic, industries and commercials are still a challenging task. Drainage pipes are using for the disposal and unfortunately sometimes there may be loss of human life while cleaning the blockages in the drainage system.

The Automatic Drainage Scrap Cleaning and Collecting is a machine which helps to protect the environment from different kinds of environmental hazards through the promotion waste management by the removal of garbage from the drainage system. These wastes when not removed end up settling in residential places where these wastes are burnt thereby causing climate change otherwise these wastes block the drainage systems thereby causing flooding. In this project the proposal concept is to replace the manual work in drainage cleaning by automated system. We know that water has a great importance in human being life, the water flow in drain full of wastes like polythene, bottles etc. The gutters get blocked due to these wastes in water. To overcome this problem and to save human life we implement a design “Automatic Drainage Scrap Cleaning and Collectingsystem” and we have designed our project to use this in efficient way to control the disposal of wastages and with regular filtration of wastages.

Keywords: Gear, Chain, Dc motor, Solar Panel, Teeth, Battery, IR, Arduino controlling.

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CHAPTER 1

INTRODUCTION

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 Automated 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 can do cleaning and moving process together on the drains/gutters.



Fig1.1:Manual drainage scrap cleaning

The Drainage water cleaner system are used to clean wastes from water like polythene, bottles etc. present in water. This can be used to overcome the problem of filtration of wastes from water and it save the time and cost that spend on cleaning the drainage. As the industry setup increase in the environment the water coming from industries are full of wastes like polythene, bottles, and other materials and that water mix with the other water that are used by people and we know that that water is not good for the for health of people. So, to overcome from these problems we can filter the water drainage water before it mixes with other water. This type of filtration of

water is called primary filtration. In this project we use DC or AC motor to run the system when power supply is available&the Equipment, we used to be motor, chain, driver, bucket, frame, wheel, sprocket gear, solid shaft etc. Water is a basic necessity of human and all living beings. There is a plenty of water on earth that is not suitable for human use. The impurities present in water can cause hazardous diseases. Waste water is defined as the flow of used water from homes, business industries, commercial activities and institutions which are subjected to the treatment plants by a carefully designed and engineered network of pipes. The biggest impact of cleaning the chemical wastes can cause respiratory diseases and it plays a challenging issue for the municipality officers. Water damage is classified as three types of contaminated water. They are clean water, gray water and black water.



Fig1.2:Deposition of solid waste in drainage scrap

We have built Automated 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 about todo cleaning and moving process together on the drains/gutters.

Clean water is from a broken water supply line or leaking faucet. If not treated quickly, this water can turn into black water or gray water, depending on length of time, temperature, and contact with surrounding contaminants. Gray water is

contaminated water that causes discomfort or illness. It includes washing machine overflow, toilet overflow with some urine, and dishwasher overflow. Black water is grossly contaminated and could cause severe illness or death if ingested and avoided such as flooding from rivers or streams, water from beyond the toilet trap, water from the toilet bowl, or standing water that has begun to support microbial growth. A drainage ditch is a narrow channel that is dug at the side of a road or field to carry away the water. Nowadays, even though automation plays a vital role in all industrial applications in the proper disposal of sewages from industries and sewage cleaning is still a challenging task. Drainage pipes are used for the disposal of sewage and unfortunately sometimes there may be loss of human life while cleaning the blockages in the drainage pipes. The municipality workers are only responsible to ensure that the sewage is clean or not. Though they clean the ditches at the side of buildings, they can't clean in very wide sewages. The municipality workers need to get down into the sewage sludge to clean the wide sewage. It affects their health badly and also causes skin allergies. With the continued expansion of industries, the problem of sewage water must be urgently resolved due to the increasing sewage problems from industries to the surrounding environment. To overcome this problem and to save the human life this design of sewage cleaning machine is proposed. In the proposal concept, the manual work in drainage cleaning is replaced by an automated system. The existing system is designed to reduce the load of workers and to make clean India.

Automated drainage water cleaning and control system using auto mechanism proposed to overcome the real time problems. With the continued expansion of industries, the problem of sewage water must be urgently resolved due to the increasing sewage problems from industries of the surrounding environment. Our proposed system is to clean and control the drainage level using auto mechanism technique. Auto mechanism is the major controlling unit and the drainage level monitor by municipal. In this system we used hand wheel, chain, driver, bucket, and frame.

CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

Our literature review is on the problem of flooding and climate change has become outrageous because of its recent trends in our environment today. This has become a cause of major concern to the world, especially the developing countries. Water running through a water drainage system mostly carries along waste materials most which are non-biodegradable which not only cause flooding but also climate change. Overflow of water drainage system occurs when there is a blockage of an end of the drainage system forcing the water to find its way elsewhere apart from the mapped-out drainage system, therefore the running water spills over the horizontal height of the drainage systems spreading to regions alongside the drainage system, thereby causing problems such as pushing down of structures such as fences, water logging of farmlands and residential building, etc. The impurities present in water can cause hazardous and disease. If the draining system is considered the function of the main drainage system is to collect, transport and dispose of the water through an outfall or outlet. Impurities in drainage water can be only like empty bottles, polythene bags, papers, etc. The problem such as Environmental pollution and spreading of viral diseases are avoidable. Automation of Drainage Cleaning System would reduce the risk of various diseases spread due to accumulation of waste. This Drainage Cleaning system will clean the waste at the surface of drainage which would allow the flow of water. The devices are place across drain so that only water flow through lower grids, waste like bottle, etc. Floating in drain are lifted by teeth which is connected to chain. This chain is attached by gear driven by motor. When motor runs the chain starts to circulate making teeth to lift. The waste materials are lifted by teeth and are stored in waste storage tank.

1. Ganesh U L, showed the usage of mechanical drainage cleaner to replace the manual work required for drainage cleaning system. Drainage pipes are very dirty. Sometimes it is harmful for human life while it is need for cleaning drainage system. To overcome this problem, they implemented mechanical semi-automatic drainage water cleaner and so the water flow is efficient because of regular filtration of wastages with the help of that project. Different kinds of environment hazards reduced with the help of Drainage system machine.

2. James C. Conwell, G. E. Johnson proposed the design and construction of a new test machine configuration that offers same advantages over the traditional one. The new machine and attendant instrumentation provide more realistic chain loading and allow link tension and roller sprocket impact monitoring during normal operation. The incorporation of idle sprocket allows independent adjustment of test on length and preload.

3. S D Rahul Bharadwaj,proposed with the automatic cleaning of wastewaterto prevent global warming and melting of glaciers. The results emphasize the need of wastewater treatment plants, through which the water is treated before suspending in rivers. Firstly, power is generated, and that power is used for wastewater cleaning process.

4. Balachandraetal,reviewed about drainage cleaning to replace manual work to automated system because manually cleaning system it is harmful for human life and cleaning time, is more so to overcome this problem they implemented a design "Automatic drainage water pump monitoring and control system using PLC and SCADA". PLC and SCADA were designed. In this project to use efficient way to control the disposal of wastage regularly, treatment of disposal in different way toxic and nontoxic gases. PLC controller from Siemens was used in the treatment system of drainage wastewater control by the stepper motor, compressor, gas exhauster, pressure valve and the liquid level, flow, and other analog variables to achieve automatic control of sewage wastewater treatment.

5. Dr.K. Kumaresan explained manual work converted to automated system. Drainage pipe using for disposal and it may be loss for human life while cleaning the blockage in the drainage pipes. To overcome this problem, they implemented “Automatic Sewage Cleaning System”. They designed their project different way clearance of gaseous substance are treated separately so the flow of water efficiently. This project may be developed with the full utilization of men, machines, and materials and money. They made their project economical and efficient with the available resources. They used automation technology reletated with his application of mechanical, electronics, computer-based systems to operate and control production.

6. R. Sathiyakala, explained E bucket (electronic bucket) use for drainage cleaning system because E-bucket lifted a sewage and used evaporation treatment for this sewage wet sewage was converted into dry matters, with the of ARM board (ARDUINO) this process was performed. After this process they were add this waste a government bank without any kind of affection of the bacteria.

7. NitinSall, explained flow of used water from homes, business industries, commercial activities are called wastewater. 200- and 500-liters wastage water are generated each person every day. So, using wastewater technology that removes, rather than destroys, a pollutant in a drainage system.

8. NDUBUISI C. Daniels, et.al. Showed the Drainage system cleaner machine used to remove garbage and sewage automatically which helped to protect the environment from different kinds of environmental hazards. The drainage system cleaner has three major parts which are the Propeller, the Cleaner and the Pan all makes up for its effective functioning. [8]

CHAPTER 3

AIM AND SCOPE OF THE PROJECT

3.1 AIM OF THE PROJECT

The device is placed across drain so that only water flow through screen, the waste like bottles, plastic etc. Floating in drain are lifted by lifter which is attached with screen. Screen is connected to the shaft which is driven by chain with the help of DC motor.

- When motor runs the chain start the circulation making screen with lifter to lift waste, further it is connected to a horizontal screening and waste stored in a container.
- When the current is supplied the ardino uno control system on hear Maine working is when IR sensed the objects like any bottle etc. motor starts to rotate, there is no objects the motor is stopped this way we can save the power and machine life.(In existing method once on button continue to run motormechanicall)
- Rotary motion of the shaft is transferred to sprocket by the help of chain.
- By the help of upper sprocket, the rotary motion is transferred to lower sprocket using chain.
- The lifter is used to lift the plastic waste from the drainage are placed between two chains.
- When motor is switched on the two shafts start to rotate, thus the lifter also startsrotating.
- The lifter enters water and lift the plastic waste from water along it,
- It carries to waste and drop the waste on other assembly of sprocket, chain and shaft which moves horizontally.
- The horizontally assembly store the waste to the container from where the plastic waste can be removed by labor.

3.2 SCOPE OF THE PROJECT

We have done has a good future scope in any engineering industry. The main constraint of this device is the high initial cost but has low operating cost and can be adopted anywhere across the country at any time, any conditions for cleaning the gutters.

Our project is simply a drain wastewater cleaner machine, which is Automatically operated. Following different modification can be done to improve the output and efficiency.

The device affords plenty of scope for modifications, further improvements & operational efficiency, which should make it commercially available & attractive. If taken up for commercial production and marketed properly, we are sure it will be accepted in the industry. It has plenty of scope if the device is made larger in size.

[1]. These cleaners are easy cheapest way to fix drainage problems. Easy to operate, as no special skill is required.

[2]. Reduction of labor-oriented method of cleaning, thus upgrading dignity of labor.

[3]. Light weight and easily portable. Requires nearly 12-24 volts of power.

[4]. Large amount of garbage will collect which can be manufacturable.

CHAPTER 4

MATERIALS AND METHODS

4.1 METHODOLOGY OF RESEARCH

The device is placed across a drain so that only water flows through the lower basement. Floating waste like bottles, plastic cans, covers.... etc. is lifted by lifters which are connected to the chain. The chain revolves with the sprocket wheel which is driven by the motor. The energy provided to the motor is electrical energy. When the motor runs the chain starts to circulate making the lifter to lift. The waste material is lifted by lifter teeth and stored in storage or collecting bin. Once the collecting bin is full, the waste materials are removed from the bin.



Fig4.1: Basic Design of Automatic Drainage Scrap Cleaning and Collecting system

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 taper bars. From top shaft that motion is transferred to the bottom shaft by using sprockets and chains. The teeth 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 attached to vertical bars behind the chains.

There will be a mesh between the chains and dust bin which act as a barrier for stopping the waste without floating. When we switch on the motor the two shafts start to rotate. Thus, the teeth also start rotating. The teeth enter water while rotating when it is coming up it also lift the waste present on the water along with it. It carries the waste along with it and finally dumps that waste in dustbin during rotation.

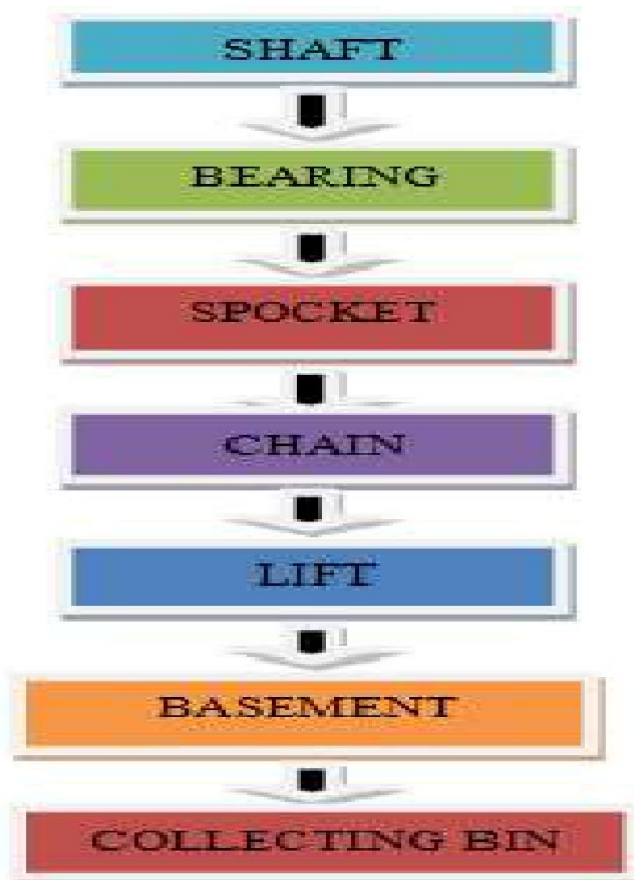


Fig 4.2:STAGE FLOW CHART IN METHODOLOGY

Methodology used for whole processing of Drainage cleaning Machine is given below this Methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner.

4.2 Major Components

4.2.1 Shaft



Fig 4.3: Shaft

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulleys and gears are mounted on it.

Material used=Mild steel.

Length=910mm

Outer Diameter=20mm

Length between shaft to shaft=930mm

Power transmitted by the shaft = 108577.5105watt

Shafts are generally formed by hot rolling and finished to size by cold drawing or turning and grinding.

4.2.2 Bearing

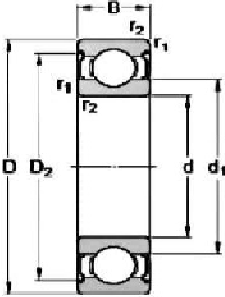
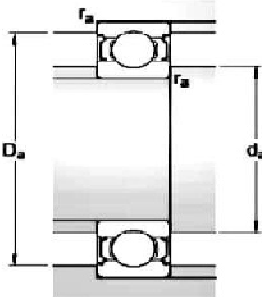


Fig4.4: Bearing

A bearing is a machine element that constrains relative motion to only the desired motion and reduces friction between moving parts. 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. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is often used to reduce friction. In the ball bearing and roller bearing, to prevent sliding friction, rolling elements such as rollers

or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance.

Bearing Specifications

Dimensions			
			
d	25	mm	
D	62	mm	
B	17	mm	
d ₁	36.6	mm	
D ₂	52.7	mm	
r _{1,2}	min. 1.1	mm	
Abutment dimensions			
			
d _a	min. 32	mm	
d _a	max. 36.5	mm	
D _a	max. 55	mm	
r _a	max. 1	mm	
Calculation data			
Basic dynamic load rating	C	23.4	kN
Basic static load rating	C ₀	11.6	kN
Fatigue load limit	P _u	0.49	kN
Reference speed		24000	r/min
Limiting speed		13000	r/min
Calculation factor	k _r	0.03	
Calculation factor	f ₀	12	
Mass			
Mass bearing		0.23	kg

4.2.3 Sprocket



Fig4.5:Sprocket

A sprocket or sprocket-wheel 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 radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed directly and differs from a pulley in that sprockets have teeth and pulleys are smooth. Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles. Sprockets are of various designs; a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a

flange. Some sprockets used with timing belts have flanges to keep the timing belt centered. Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys. They can be run at high speed and some forms of chain are so constructed as to be noiseless even at high speed.

4.2.4 Battery



Fig 4.6: Battery

Battery used A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term "accumulator "is used as it accumulates and stores energy through a reversible electrochemical reaction.

Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of electrode materials and electrolytes are used, including lead–acid, nickel–cadmium (NiCad), nickel–metal hydride (NiMH), lithium-ion (Li-ion), and lithium-ion polymer (Li-ion polymer).

Nominal battery voltage is 12V.

7Ah capacity at 20hr rate to 1.75VPC.

4.2.5 Chain



Fig 4.7: 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.

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth.

Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed, and the power is

recovered by attaching shafts or hubs to this gear. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotates once, it causes the gear that drives the wheels to rotate more than one revolution.

4.2.6 TEETH



Fig4.7: TEETH

Lifting equipment, also known as lifting bin, is a general term for any equipment that can be used to lift loads. This includes sewages like polythene, plastic bottles, wastage which generally occurs in the water, pharmacol, and other dusty and sewage partials which comes in the contact with that equipment. In our project we used two lifters for better performance, and it also help for balancing the model.

The dimension of the lifter are as follows:

Lifter of width-12.7cm, Total length of lifter-60cm, Weight of lifter-150gram, Thickness of lifter-2cm.

4.2.7 Collecting Bin.



Fig 4.9: Waste collecting bin.

Waste Collecting bin is the rectangular hollow box which is situated behind the model. It is used for the purpose of collecting the sewages which is comes in the contact of the lifter. When the lifter completes its cycle, it reaches to the bin and removes all sewage in the collecting bin. The collecting bin made up from sheet metal.

Dimension of the collecting bin

Width of collecting bin-30cm.

Depth of collecting bin- 38cm.

Length of collecting bin-75cm.

4.2.8 Solar Panel



Fig4.10: Solar Panel

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

Here, the solar panel is being used to power the battery which is used for the application of power to the mechanism of Automatic Drainage Scrap Cleaning and Collecting system.

It is a panel of 10 watts consisting of photovoltaic solar cells. Per hour solar panel charges 10 watts of power. Since to charge the panel of 25 watts it will consume 150 minutes approximately depending on the sunrays falling on the panel.

4.2.9 Gears



Fig4.11: Gears

A gear or more correctly a "gear wheel" is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part in order to transmit torque. Two or more gears working in tandem are called a transmission and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine. Geared devices can change the speed, magnitude, and direction of a power source. The most common situation is for a gear to mesh with another gear; however, a gear can also mesh a non-rotating toothed part, called a rack, thereby producing translation instead of rotation.

The gears in a transmission are analogous to the wheels in a pulley. An advantage of gears is that the teeth of a gear prevent slipping. When two gears of

unequal number of teeth are combined a mechanical advantage is produced, with both the rotational speeds and the torques of the two gears differing in a simple relationship.

In transmissions which offer multiple gear ratios, such as bicycles and cars, the term gear, as in first gear, refers to a gear ratio rather than an actual physical gear. The term is used to describe similar devices even when gear ratio is continuous rather than discrete, or when the device does not actually contain any gears, as in a continuously variable transmission.

4.2.10 Fasteners

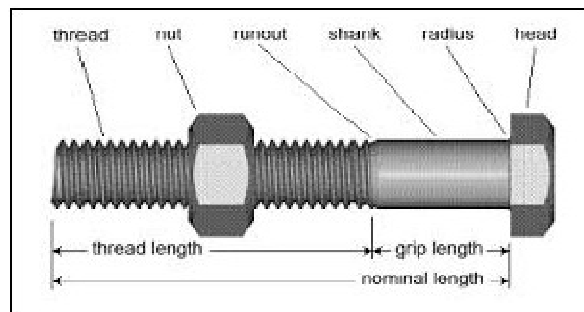


Fig4.12: Fasteners

Nut:

A nut is a type of fastener with a threaded hole. Nuts are almost always used opposite a mating bolt to fasten a stack of parts together. The two partners are kept together by a combination of their threads' friction, a slight stretch of the bolt, and compression of the parts. In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: Adhesives, safety pins or lockwire, nylon inserts, or slightly oval-shaped threads. The most common shape is hexagonal, for similar reasons as the bolt head - 6 sides give a good granularity of angles for a tool to approach from (good in tight spots), but more (and smaller) corners would be vulnerable to being rounded off. Other specialized shapes exist for

certain needs, such as wing nuts for finger adjustment and captive nuts for inaccessible areas.

Nuts are graded with strength ratings compatible with their respective bolts; for example, an ISO property class 10 nut will be able to support the bolt proof strength load of an ISO property class 10.9 bolt without stripping. Likewise, an SAE class 5 nut can support the proof load of an SAE class 5 bolt, and so on.

A wide variety of nuts exists, from household hardware versions to specialized industry-specific designs that are engineered to meet various technical standards.

Screw or Bolt

A screw, or bolt, is a type of fastener characterized by a helical ridge, known as an external thread or just thread, wrapped around a cylinder. Some screw threads are designed to mate with a complementary thread, known as an internal thread, often in the form of a nut or an object that has the internal thread formed into it. Other screw threads are designed to cut a helical groove in a softer material as the screw is inserted. The most common uses of screws are to hold objects together and to position objects.

A screw will almost always have a head, (a set screw is an example of a screw without a head) which is a specially formed section on one end of the screw that allows it to be turned or driven. Common tools for driving screws include screwdrivers and wrenches. The head is usually larger than the body of the screw, which keeps the screw from being driven deeper than the length of the screw and to provide a bearing surface. There are exceptions; for instance, carriage bolts have a domed head that is not designed to be driven; set screws often have a head smaller than the outer diameter of the screw; J-bolts have a J-shaped head which is not designed to be driven, but rather is usually sunk into concrete allowing it to be used as an anchor bolt. The cylindrical portion of the screw from the underside of the head to the tip is

known as the shank; it may be fully threaded or partially threaded. The distance between each thread is called the "pitch".

Most screws are tightened by clockwise rotation, which is termed a right-hand thread; a common device for remembering this when working with screws or bolts is "righty-tight, lefty-loose." Screws with left-hand threads are used in exceptional cases. For example, when the screw will be subject to counterclockwise torque (which would work to undo a right-hand thread), a left-hand-threaded screw would be an appropriate choice. The left side pedal of a bicycle has a left-hand thread.

4.2.11 Dc Motor



Fig4.13:DC motor

Windshield wipers are powered by a small electric motor, usually mounted on the firewall or under the cowl (the area under the windshield's base). The motor activates linkage that moves the wiper arms back and forth. On vehicles with a rear window wiper, a separate motor powers the one in the rear. Signs that a wiper motor is about to fail include slow or intermittent operation, wipers that will operate at only one speed, or arms that stop in the middle of the windshield when turned off. If your wipers don't work, the fault could also lie with other parts of the wiper system. In the winter, for example, trying to use the wipers when the blades are stuck to the windshield because of ice or snow can blow the fuse for the motor or trip a circuit breaker. Other possible causes are the interior switch that controls the wipers failing, wires in the system being damaged, or the linkage that pushes and pulls the wiper arms breaking. Moving parts in the linkage may also be stuck from corrosion and/or gunk and need lubrication.

Technical specifications

Rated torque: 53 in-lb.

Stall torque: 177 in-lb.

Unload high speed: 50rpm, 1.5A (12VDC)

Unload low speed: 35rpm, 1.0A (12VDC)

Maximum wattage: 50W/12VDC

Motor noise: <45dB

Spindle/Post thread size:

M-6 Spindle rotates 360

degrees Motor weight: 2.7

lbs.

Approx. size: 7.25"x4"x3.5"

DC motors are designed to convert electrical power into mechanical power and because of this, during periods of deceleration or if externally

driven, will generate electrical power. However, the input power is not converted into mechanical power due to the electrical resistance of the armature and other rotational losses. These losses give rise to heat generation within the motor.

Torsional Oscillation

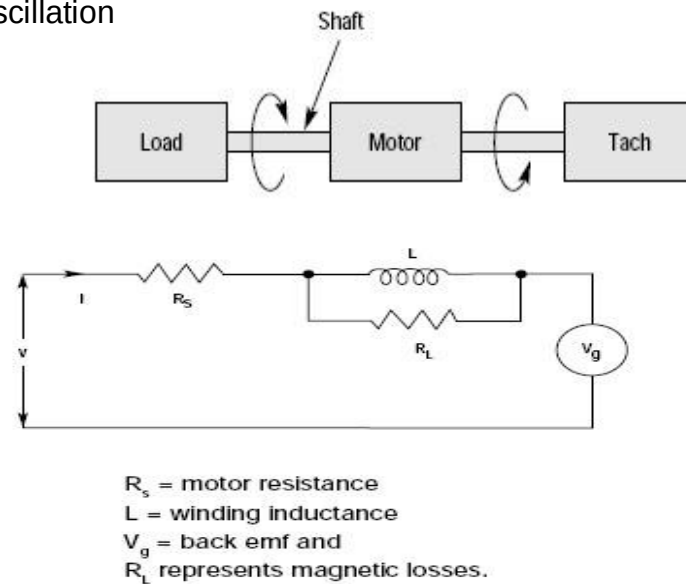


Fig 4.14:DC motor equivalent circuit

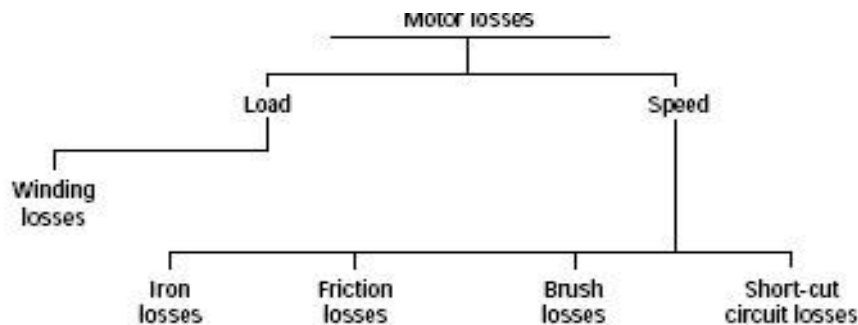


Fig 4.15:Losses in a DC motor

Winding losses

These are caused by the electrical resistance of the motor windings and are equal to I^2R (where I = armature current and R = armature resistance). As the torque output of

the motor increases, which gives rise to additional losses. Consideration of winding losses is very important since heating of the armature winding causes an increase in R , which results in further losses and heating. This process can destroy the motor if the maximum current is not limited. Furthermore, at higher temperatures, the field magnets begin to lose their strength. Hence, for a required torque output the current requirement becomes greater. Brush contact losses. These are fairly complex to analyze since they depend upon several factors that will vary with motor operation.

In general, brush contact resistance may represent a high proportion of the terminal resistance of the motor. The result of this resistance will be increased heating due to I^2R losses in the brushes and contact area. Iron losses. Iron losses are the major factor in determining the maximum speed that may be attained by an iron-cored motor. These fall into two categories:

Eddy current losses are common in all conductive cored components experiencing a changing magnetic field. Eddy currents are induced into the motor armature as it undergoes changes in magnetization. These currents are speed-dependent and have a significant heating effect at high speeds. In practice, eddy currents are reduced by producing the armature core as a series of thin, insulated sections or laminations, stacked to produce the required core length.

Hysteresis losses are caused by the resistance of the core material to constant changes of magnetic orientation, giving rise to additional heat generation, which increases with speed. Friction losses. These are associated with the mechanical characteristics of the motor and arise from brush friction, bearing friction, and air resistance. These variables will generate heat and will require additional armature current to offset this condition.

4.3 CONTROL BOARD

4.3.1 Arduino Uno (R3)

As we discussed we know that Arduino Uno is the most standard board available and probably the best choice for a beginner. We can directly connect the board to the computer via a USB Cable which performs the function of supplying the power as well as acting as a serial port.

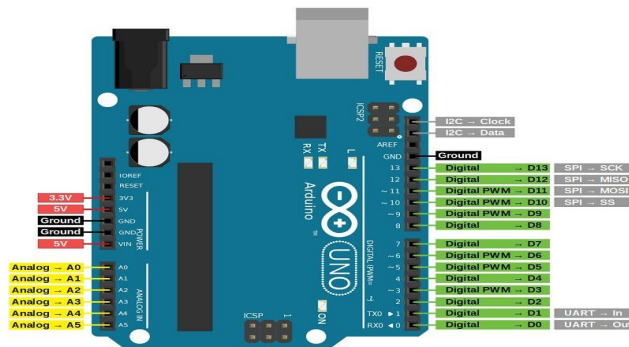


Fig4.16: Arduino Uno (R3)

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board.

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 are used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pin of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin; it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select.
2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master in Slave Out
4. SCK: Pin number 13 is used as a Serial Clock.

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

4.3.2 Arduino Mega (R3)

The most important thing about this board is that the board has more input-output pins, so it is very beneficial for the Advanced Users or the people who want more pins for their projects.

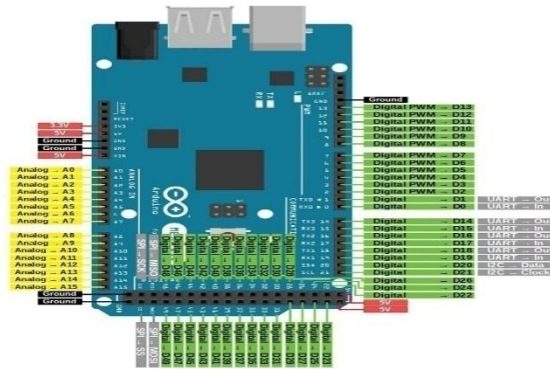


Fig4.17:Arduino Mega (R3)

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board.

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Reset the microcontroller.

Analog Pins: The pins A0 to A15 are used as an analog input and it is in the range of 0-5V. The analog pins on this board can be used as a digital Input or Output pins.

Serial pins: It is used for communication between the Arduino board and a computer or other devices.

The TXD and RXD are used to transmit & receive the serial data resp. It includes serial 0, Serial 1, serial 2, Serial 3 as follows:

1. Serial 0: It consists of Transmitter pin number 1 and receiver pin number 0.
2. Serial 1: It consists of Transmitter pin number 18 and receiver pin number 19.
3. serial 2: It consists of Transmitter pin number 16 and receiver pin number 17.
4. Serial 3: It consists of Transmitter pin number 14 and receiver pin number 15.

External Interrupts pins: This pin of the Arduino board is used to produce the External interrupt and it is done by the pin numbers 0,3,21,20,19,18.

I2C: This pin of the board is used for I2C communication.

1. Pin number 20 signifies Serial Data Line (SDA), and it is used for holding the data.
2. Pin number 21 signifies Serial Clock Line (SCL), and it is used for offering data synchronization among the devices.

SPI Pins: This is the Serial Peripheral Interface pin; it is used to maintains communication with the help of the SPI library. SPI pins include:

1. MISO: Pin number 50 is used as a Master in Slave Out
2. MOSI: Pin number 51 is used as a Master Out Slave In
3. SCK: Pin number 52 is used as a Serial Clock.
4. SS: Pin number 53 is used as a Slave Select.

4.3.3 INFRARED (IR)

4.3.3.1 IR SENSOR

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region.

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region, and far infrared region.

The wavelengths of these regions and their applications are shown below.

- Near infrared region — 700 nm to 1400 nm — IR sensors, fiber optic
- Mid infrared region — 1400 nm to 3000 nm — Heat sensing
- Far infrared region — 3000 nm to 1 mm — Thermal imaging

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LEDs of specific wavelength can be used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibres.

Optical lenses made of Quartz, Germanium and Silicon are used to focus the infrared radiation. Infrared receivers can be photodiodes, phototransistors etc. some important specifications of infrared receivers are photosensitivity, detectivity and noise equivalent power. Signal processing is done by amplifiers as the output of infrared detector is very small.

4.3.3.2 IR TRANSMITTER

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.



Fig4.18:IR LED

There are different types of infrared transmitters depending on their wavelengths, output power and response time.

A simple infrared transmitter can be constructed using an infrared LED, a current limiting resistor and a power supply. The schematic of a typical IR transmitter is shown below.

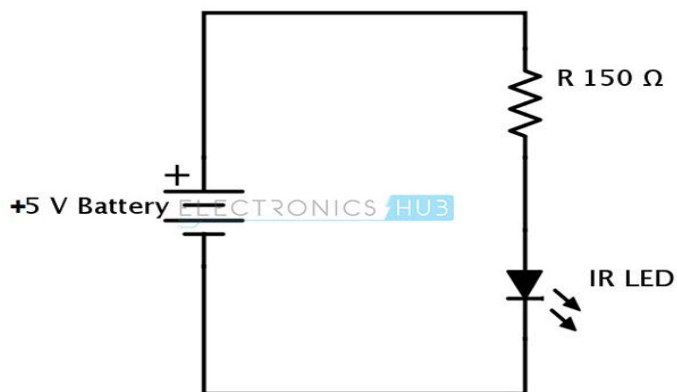


Fig 4.19: infrared transmitter circuit

When operated at a supply of 5V, the IR transmitter consumes about 3 to 5 mA of current. Infrared transmitters can be modulated to produce a particular frequency of infrared light. The most used modulation is OOK (ON – OFF – KEYING) modulation.

IR transmitters can be found in several applications. Some applications require infrared heat, and the best infrared source is infrared transmitter. When infrared emitters are used with Quartz, solar cells can be made.

4.3.4.3 IR RECEIVER

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. The picture of a typical IR receiver or a photodiode is shown below.



Fig4.20:IR Receiver

Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter.

4.3.3.4 Principle of Working

The principle of an IR sensor working as an Object Detection Sensor can be explained using the following figure. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Opti – Couple.

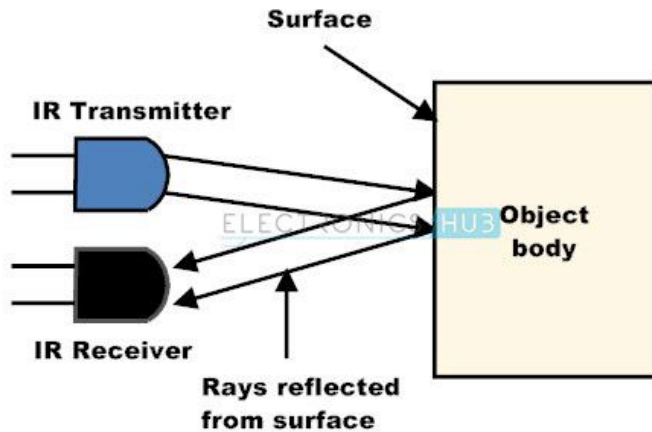


Fig4.21: Working of Principle.

When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

IR LED emits infrared light. The Photodiode detects the infrared light. An IC Op – Amp is used as a voltage comparator. The potentiometer is used to calibrate the output of the sensor according to the requirement.

When the light emitted by the IR LED is incident on the photodiode after hitting an object, the resistance of the photodiode falls from a high

value. One of the inputs of the op – amp is at threshold value set by the potentiometer. The other input to the op-amp is from the photodiode's series resistor. When the incident radiation is more on the photodiode, the voltage drop across the series resistor will be high. In the IC, both the threshold voltage and the voltage across the series resistor are compared. If the voltage across the resistor series to photodiode is greater than that of the threshold voltage, the output of the IC Op – Amp is high. As the output of the IC is connected to an LED, it lightens up. The threshold voltage can be adjusted by adjusting the potentiometer depending on the environmental conditions. The positioning of the IR LED and the IR Receiver is an

important factor. When the IR LED is held directly in front of the IR receiver, this setup is called Direct Incidence. In this case, almost the entire radiation from the IR LED will fall on the IR receiver. Hence there is a line-of-sight communication between the infrared transmitter and the receiver. If an object falls in this line, it obstructs the radiation from reaching the receiver either by reflecting the radiation or absorbing the radiation.

Distinguishing Between Black and White Colors

It is universal that black colour absorbs the entire radiation incident on it and white color reflects the entire radiation incident on it. Based on this principle, the second positioning of the sensor couple can be made. The IR LED and the photodiode are placed side by side. When the IR transmitter emits infrared radiation, since there is no direct line of contact between the transmitter and receiver, the emitted radiation must reflect to the photodiode after hitting any object. The surface of the object can be divided into two types: reflective surface and non-reflective surface. If the surface of the object is reflective in nature i.e., it is white or other light color, most of the radiation incident on it will get reflected and reaches the photodiode. Depending on the intensity of the radiation reflected, current flows in the photodiode

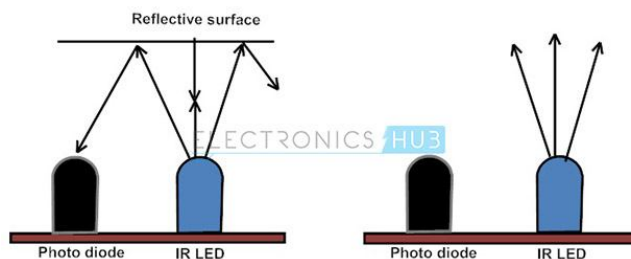


Fig 4.22: The pictorial representation of the above scenarios

The positioning and enclosing of the IR transmitter and Receiver are very important. Both the transmitter and the receiver must be placed at a certain angle, so that the detection of an object happens properly. This angle is the directivity of the sensor which is ± 45 degrees.

4.4 DESIGN OF MACHINE

4.4.1 DC Motor

The motor is being used of 12 volts and 15 watts. Since the motor is of 15 watts and from battery it requires the power of 15 watts. hence the battery could deliver the power to the motor if it charged completely for 90 mins approximately to rotate the motor.

Motor speed= $N=60$ rpm

Power= 15 watts

$$P=2\pi NT/60$$

$$T=P \times 60 / 2\pi N$$

$$= 15 \times 60 / 2\pi \times 60$$

$$T=2.387 \text{ N-m}$$

$$T=2.3875 \times 1000 \text{ N-mm}$$

Force acting on the shaft of the motor Diameter of shaft "d"
 $=6 \text{ mm}$

Torque developed.

$$T = F \times r$$

$$F=T/r= 2387.5/3$$

$$F=795.8 \text{ N}$$

The material being used for the shaft is mild steel.

$$\text{Shear stress } f_s = \sigma_y / 2 / \text{FOS}$$

(FOS=factor of safety)

$$=380/2/2$$

$$= 95\text{Mpa}$$

Load acting on the motor shaft=3kg=30 Newtons

Stress =Force/area

$$\sigma=350/ \times d^2$$

$$d= 1.53\text{mm}$$

taking diameter of shaft as 6mm for the motor

Hence the design of the motor shaft is safe.

Torque acting on the motor for load of 30N (for mild steel $\sigma_s=95 \text{ Map}$)

$$T=(\pi/16) \times \sigma_s \times (d^3)$$

$$=(\pi/16) \times 95 \times 6^3)$$

$$= 4029 \quad \text{N-mm}$$

Torque =force

*radius Force=

$$T/r=4029/3 =1343\text{N}$$

The load acting on the motor shaft is 30N since it can take load up to 1343N. Hence, design is safe.

4.4.2 Design of shafts

Load acting on the shafts=30 N

Shear strength

$\sigma_s = \text{force/area}$

$$380/2/2 = (30/(\pi d^2))$$

$$d = 2\text{mm}$$

taking 6mm

hence the design of the shaft is safe.

it can the load of the entire machine easily

Checking for crushing stress

Stress = load/ area

$$380/2/2 = 30/(\pi \times D \times L)$$

$$95 = 30/(\pi \times D \times 1.5D)$$

$$D = 0.82\text{mm}$$

Taking 6mm

Hence the design for crushing is also safe.

4.4.3 Speed of Gear

$$N_2 = N_1/I = 60/2.5$$

$$N_2 = 24\text{rpm}$$

Stress in pinion and gear

$$S_d1 = 140\text{Mpa}(\text{pinion})$$

$$S_d2 = 90\text{Mpa}(\text{gear})$$

4.4.4 Lewis Form Factor

$$Y_1 = 0.124 - (0.684/Z_1)$$

$$= 0.124 - (0.684/54)$$

$$=0.1113$$

$$Y_2 = 0.124 - (0.684/Z_2)$$

$$= 0.124 -$$

$$(0.684/135)$$

$$=0.1189$$

4.4.5 Torque Developed.

$$T_2 = (955 \cdot 10^4 \cdot \text{Power} \cdot C_s) / N_2$$

$$= (955 \cdot 10^4 \cdot 0.015 \cdot 1.25) / 24$$

$$= 7.46 \cdot 10^3 \text{ N-mm}$$

4.4.6 Mean Velocity

$$V_m = (3.142 \cdot d_2 \cdot N_2) / (60 \cdot 1000)$$

$$= (3.142 \cdot m \cdot Z_2^2) / (60 \cdot 1000)$$

$$= (3.142 \cdot m \cdot 135^2) / (60 \cdot 1000)$$

$$= 0.169 \text{ m}$$

4.2.8 Velocity Factor

$$K_v = (3 / (3 + V_m))$$

$$= (3 / (3 + 0.169 \text{ m}))$$

Assume $\beta = 4$

4.2.9 Module

$$m^3 = (2T_2) / ((\pi^2) \cdot \beta \cdot Y_2 \cdot Z_2^2 \cdot S_d^2 \cdot K_v)$$

$$(2 \cdot 7.46 \cdot 1000) \cdot (3 + 0.169 \text{ m}) / (\pi^2 \cdot 4 \cdot 0.1189 \cdot 135^2 \cdot 90^3) = 0.64 = 1 \text{ mm}$$

4.4.7 Diameters

Pitch diameter of pinion

$$D_1 = m \cdot Z_1 = 1 \cdot 54$$

$$D1=54\text{mm}$$

Pitch diameter of gear

$$D2=M*z2$$

$$=1*135 =135\text{mm}$$

4.4.8 Face Width

$$B=4\pi m=4*3.142*1$$

$$B=12.56\text{mm}$$

4.4.9 Allowable stress & Induced stress

$$S_{all}=K_v*S_d2$$

$$=0.946*90$$

$$=85.14\text{M}$$

Induced stress:

$$m^3 = (2T2) / ((\pi^2) * \beta * Y2 * Z2 * S_{din} * K_v)$$

$$S_{din} = (2*7.46*1000) / (\pi^2 * 4 * 0.1189 * 135 * (1^3))$$

$$S_{din} = 23.5 \text{ Mpa}$$

Since S_{din} is less than S_{dall}

Therefore, the design is safe.

4.4.10 Solar panel

Battery

$$\text{Voltage}=V=12\text{volts}$$

Current= $I = 07$ amps

Power of battery

$$P = V \times I$$

$$= 12 \times 7$$

$$P = 84 \text{ watts}$$

To charge the battery of 84 watts .it takes nearly 8.4 hours approximately to charge the entire battery.

4.5 Maintenance

Preventive Maintenance are as follows:

- 1) Charging of battery should be done regularly with solar panel.
- 2) Supply should be connected properly.
- 3) Should take care from rusting of parts.
- 4) Each part should be sprayed with oil to prevent from corrosion.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 FABRICATION OF MODEL



Fig5.1: Fabrication of the Project model

Basically, during fabrication of the model, the basement part is prepared by welding the metal bars by electric welding. Then the supporting rods are welded at an angle of 90 degree from the basement, the pillow block bearings are fixed to the supporting rod and the front part of the basement. Hollow cylindrical shafts are fixed to the bearings and chain drive is also fixed to the shaft to fix the shafts the factor of safety of the chain is calculated. The lifters are fixed to the chain by gas welding at an equal distance from each.



Fig 5.2:Graph of time v/s collecting bin.

- Time taken by each lifter to lift each object from bottom to top is 11.46 seconds.
- Min time taken by collecting bin to fill completely is 1 day.
- Quantity of waste collecting in the collecting bin is nearly 8-9 kilograms.
- The below graph which is drawn time v/s collecting bin explains that how much waste is collected in the bin with respect to time.

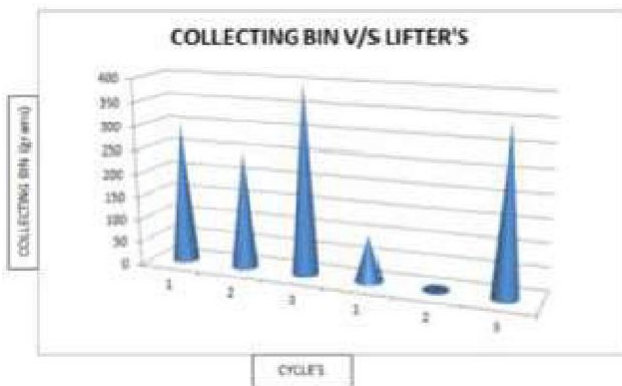


Fig5.3:Graph of cycle v/s collecting bin.

While considering the above graph collecting bin v/s one complete cycle indicates that the rate of lifter lifting the waste is directly proposal to the storage of waste in the collecting bin.



Fig5.4: Side view of machine



Fig 5.5:Front view of machine

Automated drainage water cleaning and control system using auto mechanism proposed to overcome the real time problems. With the continued expansion of industries, the problem of sewage water must be urgently resolved due to the increasing sewage problems from industries of the surrounding environment. Our proposed system is used to cleaning and control the drainage level using auto mechanism technique.

Along with snow and ice during the winter months, they can eventually fall off. And if they are not free of debris, such as leaves, twigs, acorns, etc., it can stop the flow of water out to the street and eventually it will find its way back to the foundation of the house. Depending on the number of trees around a house, the average homeowner may need to clean them two or more times a year and this are usually done manually.

A robotic device that could clean gutters without putting people in harm's way of climbing a ladder onto the roof of a house would an ideal solution.

5.2 WORKING PRINCIPLE

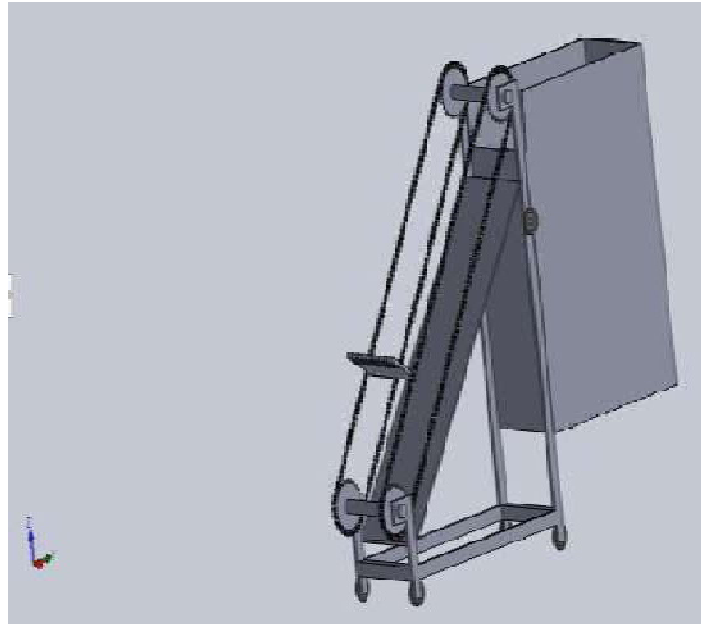


Fig5.6:3D design of gutter cleaning system

The devices are placed across drain so that only water flows through lower grids, while waste like bottles, etc., floating in the drain are lifted by teeth connected to a chain. This chain is attached to a gear driven by a motor. When the motor runs, the chain starts to circulate, making the teeth lift the waste materials. The waste materials are lifted by the teeth and are stored in a waste storage tank. The lower shaft and wheel arrangement is placed for transporting the machine from one place to another place as well as from one gutter to another gutter. The upper shaft and wheel arrangement help in moving the machine during the cleaning process. In other words, the gutter and drain cleaner move together for better cleaning of the gutter.

Reduce, reuse, recycle. Reducing the quantity of waste that must be transported and disposed of should be a primary goal of all municipal solid waste management programs. Waste should be recovered at the source, during transport or at the disposal site. The earlier the separation, the cleaner the material, and, in the

end, the higher its quality and its value to users. Incentives which integrate and foster the

CHAPTER 6

SUMMARY AND CONCLUSION OF THE RESEARCH

In the treatment system of drainage, wastewater control by the machine and the collecting bin to achieve automatic control of wastewater treatment. Drainage from domestic and industries is treated through this project to meet the national emission standards, with stable operation, low cost and good effect. The cleaner functions more effectively during the heavier rains which has more volume of running water with garbage and high velocity.

Risk of Labors catching infections or poisoning due to large amounts of waste and chemicals will be reduced. Automation is a technology concerned with his application of mechanical, electronic, and computer-based systems to operate and control production. This system is used To Operate Automated Gutter Cleaning System.

This project may be developed with the full utilization of men, machines, and materials and money. Also, we have followed thoroughly the study of time motion and made our project economical and efficient with the available resources. This system is Designed, fabricated successfully, and tested. It works satisfactorily. We hope that this will be done among the most versatile and interchangeable one even in future. Thus, we can be able to obtain following through Automated Gutter Cleaning system.

This project may be developed with the full utilization of men, machines, and materials and money. Also, we have followed thoroughly the study of time motion and made our project economical and efficient with the available resources. This system is Designed, fabricated successfully, and tested. It works satisfactorily. We hope that this will be done among the most versatile and interchangeable one even in future. Thus, we can be able to obtain following through Automatic Drainage Scrap Cleaning and Collecting system.

1 ADVANTAGES:

- Easy maintenance
- Low cost
- Reduce men power.
- Simple in construction
- It is compact and portable.

2. DISADVANTAGE:

- Continuous power required to operate.
- Containers need to be clean time to time.
- Rusting risks of System
- Material selection & design

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