A GENERAL PAPER ON "AUTOMATIC DRAINAGE CLEANING SYSTEM"

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ABSTRACT

Water is a basic necessity of humans and all living beings.There is plenty of water on earth but that is not suitable for human use.Clean water is more important if used for some purpose.The impurities present in water can cause hazards and diseases.The main function of the drainage system is to collect,transport and dispose of the waste like empty bottles,polythene bags,papers,etc.This impurities present in the drainage water can cause blockages.The drainage system can be cleaned time to time manually or such a system can be designed that will automatically throw out the wastage and will keep the water clean.This project is designed to keep clean the drainage system and help the smooth working of the system.This project automatically cleans the water in the drainage system and this forms the efficient and easy way of cleaning the drainage system and preventing the blockage.

Index Terms: Drainage cleaner, floating waste

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 river,in the ponds and in the ocean.In which more solid ingredients (polythene,bottles,etc) along with water also reaches.We have built Automated drain cleaning system with the main purpose of removing these solid materials from drains.This machine can be established at any point of drain easily.It has been designed in such a way that it lets water flow through it but collects all the solid substances and gives a group in the collector.

The drainage water cleaner system are used to clean 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 the industries are full of wastes like polythenes,bottles,and other materials and the water mix with the other water that are used by people and we know that the water is not good for the health of people.So to overcome this problem we filter the drainage water before it mix with the other water.This type of filtration is called primary filtration.In this project we use DC motor to run the system when power supply is available and the equipment we use are motor,chain,driver,bucket,frame,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 the water can cause hazardous diseases.Waste water is defined as the flow of used water from the 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 .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 must be urgently resolved due to increasing sewage problems from industries of the surrounding environment.Our proposed system is to clean and control the drainage level using auto mechanism technique.In this system we use motor, battery, chain, bucket, frame, etc.

2. RELATED WORK

a. **R.Sathiyakala 2016**, said that the usage of mechanical drainage system cleaner to replace the manual work required for drainage cleaning system.Draiage 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 a mechanical semi-automated drainage water cleaner and so the water flow efficient because the regular filtration of the wastage with the help of that project.

b. **Mhael Okpara (2014)** reviewed about drainage cleaning to replace manual work to automated system because manually cleaning system it is harmfull for human life and cleaning time is more so to overcome this problem they implemented a design "automatic drainage waterpump monitoring and control system using PLC and SCADA".In this project they use the efficient way to control the disposal of wastages regularlytreatment of disposal in different way toxic and non toxic.

c. **Yadav, D (2014)** said today the advanced time has such a variety of advanced for make our life modern.Like the cleaning procedure is likewise play a critical part.For example, our smart cleaning system do the residential reason cleaning flawlessly and keep and keep the mosquitos era from the sewage by the way intestinal sickness, influenza and so forth illnesses are stay away from the future to robotization cleaning framework will be lies on each different house sewage cleaning framework.

d. **Bharat, K. And G.A.Mihaila,(2002)**, said that mechanization is an innovation worried with his utilization of mechanical,electronic and pc based framework to work control generation.This frame work utilized to operate automatic sewage cleaning equipment.This venture might be created with the full use of men,machines,material and cash.Additionally we have taken after altogether the investigation of time movement and made our venture temperatureand productive with the accessible assets.This paper depend upon the automatic control of seawage treatment.It is not depend upon the deposited sludge of the drainage system.The purpose is this paper are design the mechanical drainage system,taking into account the various factor that might affect the functionality of the equipment.

e. **Karthikeyan** explained flow of used water from homes, business, industry, and commercial activities are called waste water.200 and 500 litter wastage water are generated by each person everyday.So using waste water technology that removes a pollutant in a drainage system.

f. **S S Ratan** explained a bucket use for drainage system because bucket lifted sewage and used evaporation system for this wet sewage was converted into dry matters, wwith the ARM board this process was performed.After this process they were add this waste a government without any kind of affection of the bacteria.

g. **K Raghavendra (2015),** explained removes an unwanted phenomenon, by using chain drive simulation program.It is used as an alternative to or in combination with physical experiment.They formed a specific model of the marine engine chain drive for a large speed system.They used contact force method for simulation analysis.Performed a dynamic simulation of large marine engine chain drive.

h. **K Mahadevan and balveera** reedy proposed safe load for the chain and ability of the same to withstand the use of finite element modelling will be the core objective of the work.An existing chain link used for benchmarking the research work.The FEM method is used to analyze the stress state of the elastic body with the given geometry, such as chain link.

i. **Dr.K.Kumesaran M.E(2013)** showed the research was an assessment of drainage problem in the tropical environment of llorin,Nigeria.In order to achieve a philosophy of work,such a data have been sourced from direct field work.Such data include drainage dimensions,types of waste in drainage channels,problems of waste and technique for waste management.

3. METHODOLOGY

The device is place 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 motor runs the chain starts to circulate making the lifter to lift up. The wastage material are 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.

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 tapper bars. From top shaft that motion is transferred to the bottom shaft by using sprockets and chains. The teeth which is 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 shafts starts to rotate.Thus the teeth also starts to rotate.The teeth enters into water while rotating when it is coming up it also lifts 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.

CALCULATIONS

DC Motor:

Motor speed=N=60 rpm

Power=15 watts

$P=2\pi NT/60$

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

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

$T=2.387$N-m

$T=2.3875\times 1000$ N-mm

Force acting on the shaft of the motor

Diameter of shaft "d"=6mm

Torque developed

$T = F*r$

$F=T/r= 2387.5/3$

$F=795.8$N

The material being used for the shaft is mild steel

Yield stress σ_y=380 Mpa for M S Material

Shear stress $fs=\sigma_y/2/FOS$ (FOS=factor of safety)

$=380/2/2$

$=95$Mpa

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

Stress =Force/area

$$\sigma = 350/\frac{\pi \times d^2}{4}$$

d= 1.53mm

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 σ_s=95Mpa)

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

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

= 4029 N-mm

Torque =force *radius

Force= T/r=4029/3

=1343N

The load acting on the motor shaft is 30N, since it can take load upto 1343N.

Hence, design is safe.

Design of shaft:

Load acting on the shafts=30 N

Shear strength

σ_s=force/area

$$380/2/2= (30/ (\frac{\pi d^2}{4}))$$

d=2mm

Taking 6mm

Hence the design of the shaft is safe

It cans the load of the entire machine easily

Checking for crushing stress

Stress = load/ area

380/2/2= 30/ (π×D×L)

95=30/ (π×D×1.5D)

D=0.82mm

Taking 6mm

Hence the design for crushing is also safe.

Design of Gears:

Power=15watts 14.5degrees (FDI)

Speed ofpinionN1=60rpm Z1=54 teeth Z2=135teeth

I=Z2/Z1

=135/54

=2.5

Speed of Gear:

N2=N1/I =60/2.5

N2=24rpm

Stress in pinion and gear

Sd1=140Mpa (pinion)

Sd2=90Mpa (gear)

Lewis Form Factor:

Y1=0.124-(0.684/Z1)

=0.124-(0.684/54)

=0.1113

Y2= 0.124-(0.684/Z2)

= 0.124-(0.684/135)

=0.1189

Torque Developed:

T2= (955*10^ (4)*Power*Cs)/N2

= (955*10^ (4)*0.015*1.25)/24

=7.46*10^ (3) N-mm

Mean Velocity:

Vm= (3.142*d2*N2)/ (60*1000)

= (3.142*m*Z2*24)/ (60*1000)

= (3.142*m*135*24)/ (60*1000)

=0.169m

Velocity Factor:

Kv= (3/ (3+Vm))

= (3/ (3+0.169m))

Assume β=4

Module:

M^ (3) = (2T2)/ ((π^ (2)*β*Y2*Z2*Sd2*Kv)

= (2*7.46*1000)*? (3+0.169m)/ (π^ (2)*4*0.1189*135*90*3)

=0.64=1mm

Diameters:

Pitch diameter of pinion

D1=m*Z1
=1*54
D1=54mm
Pitch diameter of gear
D2=M*z2
=1*135
D2 =135mm

Face Width:

B=4πm=4*3.142*1
B=12.56mm

Mean Velocity:

Vm=0.169m
=0.169*1
=0.169m/s

Velocity Factor:

Kv= (3/ (3+Vm))
= (3/ (3+0.169)
=0.946

Allowable stress:

Stall=Kv*Sd2
=0.946*90
=85.14Mpa

Induced stress:

M^ (3) = (2T2)/ ((π^ (2)*β*Y2*Z2*Sdin*Kv)
Sdin= (2*7.46*1000)/ (π^2*4*0.1189*135*(1^3))
Sdin =23.5 Mpa
Since Sdin is less than Sdall
Therefore the design is safe.

5. DESCRIPTION OF COMPONENTS

a. 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 unit.

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.

b. 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.

c. 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 together 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 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 athigh speed.

d. 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 (NiCd), 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.

Standard dimension of 151mm x 65mm x 97.5mm (L x W x H with terminal)

Charging temperature range from -15°C to 50°C.

Discharging temperature range from -20°C to 60°C.

Battery weight is 2.2Kg.

e. 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.

f. Lifter mounts:

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, thermocol, and other dusty and sewage partials which comes in the contact with that equipment. In our project we used two lifter for better performance, and it also help for balancing the model.

The dimensions of the lifter are as follows:

Lifter of width-12.7cm

Total length of lifter-60cm

Weight of lifter-150gram

Thickness of lifter- 4mm

g. Collecting bin:

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 come 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 tank 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

h. Gear:

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.

i. 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 orlockwire, 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.

j. 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.

k. Arduino uno:

The Arduino Uno is an open source microcontroller based on the Microchip ATmega328P microcontroller and developed by Aurduino.cc.The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.The board has 14 digital I/O pins (six capable of PWM output),6 analog I/O ,and is programmable with the Arduino IDE (Integrated Development Environment),via a type B USB cable.It can be powered by the USB cable or by an external 9-volt battery,though it accepts voltages between 7 and 20 volts.It is similar to the Aurduino Nano and Leonardo.The hardware reference design is distributed under a creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website.Layout and production files for some versions of the hardware are also available.

l. Proximity sensor:

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact.A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared,for instance),and looks for changes in the field or return signal.The object being sensed is often referred to as the proximity sensors target.Different proximity sensor targets demand different sensors.For example,a capacitive proximity sensor or photoelectric sensor might be suitable for a plastic target;an inductive proximity sensor always require a metal target.Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between the sensor and the sensed object.

m. 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 gunkand need lubrication.

Technical specifications:

- Rated torque: 53in-lb
- Stall torque: 177in-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 360degrees
- Motor weight: 2.7lbs
- Approx size:7.25"x4"x3.5"

CONCLUSION

In the treatment system of drainage, waste water control by the machine and the collecting bin to achieve automatic control of waste water 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 have 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 drain 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 also tested. It works satisfactorily. We hope that this will be done among the most versatile and interchangeable one even in future. Thus we can able to obtain following through Automated drain Cleaning system.

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