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Development and Study of Automated Drainage Cleaner

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***Abstract*: This project is about replacing the manual work in drainage cleaning by an automated system. Nowadays, automation plays a vital role in all industrial applications. Yet, the proper disposal of sewage from industries is still a challenging task. Sewage is used for the disposal and unfortunately, sometimes there may be loss of human life while cleaning the blockage in the drainage. To overcome the problems in manual drain cleaning, we are implementing a "Design and Fabrication of Automated Drainage Cleaner". In this newly developed model, we have studied previous working and their drawback. The machine is given the opportunity for the movement from one place to another and as the water-related work ground clearance for the motor have been provided and power is transmitted via simple chain-drive mechanisms and electronics components have greatly reduced by using RF transmitter and receiver so that the operating range has been increased.**

***Keywords*: RF drive, 12v DC geared motor, Arduino, battery 12v, relay board, sprocket, control unit, ball bearing.**

1. Introduction

Water is basic for all the plants and animals and also a human being. In the using water, the water gets dirty and runs along the sewage, where the waste product like polythene bag, plastic bottles and so many things thrown into the sewages by peoples. After few products come and stored in the place causes some shortage of space that place gets risky because of so many plastic products arrests the water in there. The sewage cleaning is uneasy process which many feel shy to work in it. So we have developed a new method to automate the process and reducing the human involvement. Work can be done through simple wireless operations and make our surroundings clean. These dumped particles can be removed manually by humans which causes some serious diseases. In this project get some new device to control the sewage machine-like semi- automated. This is the efficient and the easy way for cleaning and the system to the management of line which led to chronic and some other diseases. In that semi-automatic cleaning machine using the RF drive is it just like the transfer and receiver the data by the controller, in that controlling the device to control the machine in forward and backwards and also in turn on the cleaning process by the RF devices and the analysis of the chain mechanism to pull the bucket with solid waste to the working process going to see.

2. The Necessity of the Study

The market study on the necessity of skilled labor for the manual drainage cleaning process conducted at sathyamangalam market among a group of Drainage cleaners:

- to collect information on the current procedures and the limitations of the same;
- to identify the current requirements, disagreements and future needs of the current beneficiaries in order to improve the activity of the companies and to anticipate the future trend;
- to identify new beneficiaries;
- to test the reaction of the industrial consumers to such actions, which are usually seen in a structured market economy.

3. Design of the Component

A. Solidworks

SolidWorks is a solid modeling computer-aided design and computer-aided engineering computer program published by Dassault Systèmes, that runs primarily on Microsoft Windows. While it is possible to run SolidWorks on an Intel-based Mac with Windows installed, the application's developer recommends against this.

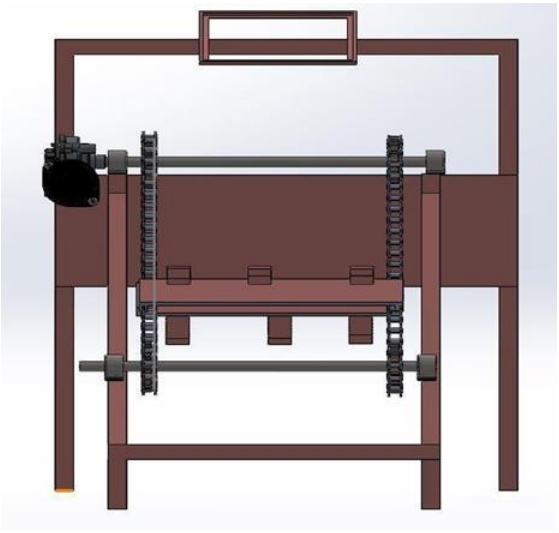

Fig. 1. Front view

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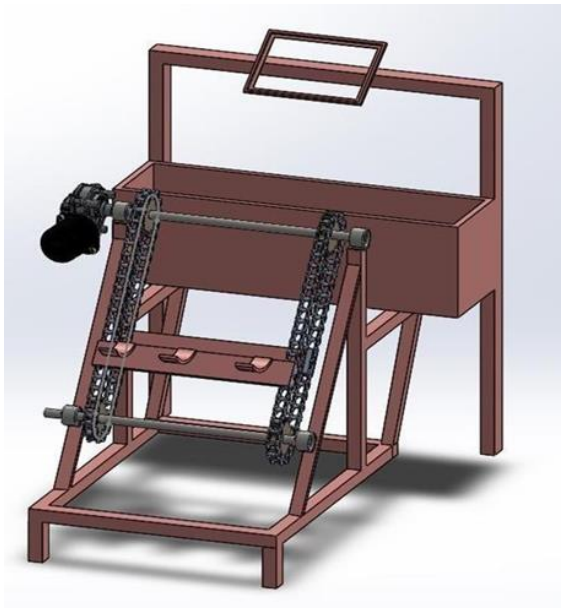

Fig. 2. 3D view

4. Formula Used for Design

A. Battery Performance and Calculation

Battery ampere per hrs/current = 8/420
= 19 hrs,
Watt= 18w Volt= 12v
To calculate current Power= (voltage)(Current) 18= (12)(1)
I= 3/2
I 1.5 ampere
Battery performance
Battery ampere per hrs/I Performance = 8/1.5
Total working time = 5.3 hrs.

DC Motor Calculation:
N= 100rpm V= 12volt P= 100watt

Motor Torque:
T= (power)(60)/(2)(pi)(n)
T= (100)(60)/(2)(3.14)(100)
T= 9.554 Nm
The allowable shear stress for mild steel is 42 Mega pascal T= (pi)(safety factor)(diameter)/16
9554= 3.14*42*diameter/16 Diameter = 10,50mm
The standard size is 11 millimeters.

Ball Bearing Calculation:
The radial load= 700N The thrust load= 300N Service factor= 1.2 Usage time= 35hrs/week Usage= 3years N=500rpm
Shaft diameter= 15mm

Bearing Life:
Bearing life= 35*3*52
=5460hrs.
Equivalent load (P)= (X Fr + y Fa)s Factor of load= 0.56
Factor of thrust= 1.4 (From PSGDB 4.4 and 4.6)
P= (0.56*700 + 1.4*300)1.2
=812N
Loading ratio= c/p (From PSGDB 4.14)
=6.2
C= 6.2*p
=6.2*812
=5034N C=880kg F= 8800N
Since C= 8800>5034, the selected bearing is suitable.
Selected bearing= SKF6302.

B. Chain Drive and Sprocket Calculation

Determine the velocity ratio of the chain drive
Ratio of velocity= speed of sprocket s1/ speed of sprocket 2 Speed of sprocket 1= sn1
Speed of sprocket 2= sn2 Teeth in sprocket 1= st1 Teeth in sprocket 2= st2 Sn1/sn2=st1/st2
Sn1= 20 Sn2= ? St1= 36
St2= 18
Sn1/sn2=st1/st2 30/sn2=36/18 Sn2= 30/2 Sn2= 15
Ratio of velocity= sn1/sn2
=30/15
Ratio=2
The small sprocket in chain drive mechanism has at least the minimum of about 18teeth. The large sprocket in chain drive mechanism has maximum of about 36 teeth in its position.

The design powers DP= design power
DP= (power rating) (ks) Ks= (k1) (K1u)(K3)
= (0.25) (K1)(K1u)(K3)
= (0.25) (1.5) (1) (1.25)
Design power is 450 w

Table 1
Design parameters of the components

Design parameter	Value
Chain length	1200mm
Machine framework	900*600mm
Sprocket larger teeth	36teeth
Sprocket smaller teeth	18teeth
Ball bearing outside diameter	42mm
Ball bearing inside diameter	15mm
Ball bearing width diameter	13mm
Life of bearing	5460hrs

The table 1 shows the design parameters of the components.

Pitch Diameter:
Diameter= p/(sin(180/t))
=9.525/(sin(180/18))
=9.525/0.173648
Pitch circle diameter D= 54.85mm
The load (W) on the chain. Pitvh velocity= II dn/60
=(3.14)(0.065*100)/60
Pitch velocity= 0.34m/s
Load= power rate/ pitch velocity Load= 0.25/pitch line velocity Load= 0.25/0.34
Load= 0.735KN
Load on the chain is 735N.

Factor of Safety:

Factor of safety= braking load/ load on chain Factor of safety= (wb)(wl)

=8.9/0.735

Factor of safety is 12.

Construction:

The base frame of mild steel which acts a bed of machine is fabricated with the help of square tubes and channels by metal cutting and metal joining process called welding. An 12V DC geared motor is mounted rigidly to the base frame, whose output shaft is connected with chain sprocket. At the top portion of frame an operational shaft is fixed with the help of bearing supported ends in order to attain friction free rotation. The control unit and Arduino are connected to the base frame. The pulley at operational shaft and DC motor is connected with each other through chain drive. Below the frame the wheels are attached for easy transportation.

Materials used:

- 12V DC Geared Motor
- Control Unit
- Battery 12V
- Chain (simple roller chain)
- Sprocket
- Ball bearing
- Mild steel (framework)
- Wheels
- Relay board
- Arduino (Micro controller) and WIFI module

Table 2
Specifications

S. No.	Specification	Limit
1.	Voltage	12v
2.	Test voltage	13.5v
3.	Brake torque	26Nm
4.	Working torque	9.5Nm
5.	No load speed	35-100Rpm
6.	No load current	1.2-2.2A
7.	Working amps	4.3-6A

5. Working Principle

The collecting plate is coupled between the two chain drives to collect the waste materials from the drainage. Then the collected wastages are thrown on the collecting tray. The IOT app (mobile) keypad is used to control the direction of the motor which is coupled with the spur gear. Relay is directly connected with the DC motor When the start key is pressed the motor is operated in forward direction and the when the stop key is pressed the motor is stops automatically. The forward and reverse button in the remote is used to operate the motor is required directions.

Advantages:

- Production cost is very low.
- No need of purchase special machine.
- It is mainly very useful to hold the lengthy plate (1.5 feet) in particular position.
- Its operated and maintenance is simple.
- It is compact and portable.
- It can be efficiently used.

Fig. 3. Working model

Fig. 4. Side view of working model

6. Conclusion

In this project we seen the changing the design of machine to movable to place to another place easily control the sewage cleaning machine by using the RF controller, in that control to attain multiple propose dealing in this machine. In this power supply give in to the motor, in the two-motor using one is working for moving motion and another is process of cleaning mechanism. In the moving motion to control the motion in forward and backward and cleaning mechanism to forward and backward in chain mechanism by analysis of the chain structural and yield strength.

The main defects identified were;

- Initial adjustments for the workers.
- Maintenance cost.
- Even though the need of skilled labor was not required the labor had to be extremely careful while

operating the machine.

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