DESIGN OF ECO-FRIENDLY ROAD AND FLOOR CLEANER

Shingala Niraj R.[1], Kondhiya Pankit B.[2], Hardik A Khunt[3], Dr. Arick M. Lakhani[4], Parth V. Delvadiya[5]

[1,2,3,4,5]Assistance Professor, Mechanical Department, VVP Engineering College,Rajkot
Mechanical Dept, V.V.P Engineering Collage Rajkot.

Abstract - Cleaning has become a basic need for all human beings and it is unavoidable daily routine process. The conventional road cleaning machine is most widely used in railway stations, airports, hospitals, Bus stands, etc. also this machine needs electrical energy for its operation. It is not user friendly as well as eco-friendly. In summertime there is power crisis and most of the roads cleaning machines are not used effectively duetothisproblemparticularly.Inourprojectwe are using easily available materials with low cost. It is the better alternative for conventional machine.

KeyWords:RoadCleaner,ManuallyOperated,Eco-Friendly, Human Powered,Analysis.

1.INTRODUCTION

Effectivecleaningandsanitizinghelpandprotectthe health of the human beings directly and indirectly. Also, cleaning and sanitizing prevents the pest infestationsbyreducingresiduesthatcanattractand supportbees,pestsetc.Italsoimprovestheshelflife of the floor, walls etc. due to regular cleaning and maintenance. In recent years, most of the people prefertousetrainsorbusesforcommutingandhence these places are littered with biscuits covers, cold drinkbottlesetc.Hence,itisnecessarytocleanthebus standsandrailwaysstationsatregularinterval.There isnoonesinglecleaningmethodthatissuitableforall locations and occasions and effective cleaning depends upon type of cleaning device, cleaning techniqueandtheequipmentshouldbeuserfriendly

Cleaning work can be physically demanding, and a need has been identified to developed methods for systematicergonomicevaluationofnewproducts.In recent years, floor cleaning robots are getting more popularforbusyandagingpopulationsduetolackof workers. However, in India, unemployment is more and hence there is a need to develop less labour orientedcleaningmachine.Hence,thepresentworkis aimed to design, development and evaluation of a manually operated road cleaning machine. AmaechiLawrenceetalevaluationhasshownhowthe use of multiple assessment techniques can providea comprehensiveappraisalofthedesign,usabilityand musculoskeletal loading upon the operator. They suggested that the trials with a larger number of subjects would certainly strengthen theconclusions. AbhishekChakrabortyetal[6]reportedthatthemost significant cause of road dust to the total suspended particulate burden is vehicle traveling on paved and unpaved' surfaces. Consequently, data directly relatingdusttoroadaccidentsarerare,butinastudy if dust is the cause of 10% of these accidents' casualties,thenthecostcouldamounttoasmuchas 0.02%ofGDPinsomedevelopingcountriesandtotal about$800millionannually.Thepresentstateofthe road cleaning process is described below. There are two ways for road cleaning 1) Manual process 2) Machinated process. In manual process, the road cleaning is done with the help of and shovel to clean off the debris, waste etc. hand to clean the road by spreading the dust all over in the air. While in the Machinated process, a vehicle containing broom at bottomcontinuouslyrotating,cleantheroadaswellas sucksthedustspreadbyrotatingbroom.

Background Of Present Road Cleaning:

The manual operated machines are time consumingandlaborious,onothersideoftheflip,the diesel operated machines are very costlier. These problems instigate to think an alternative arrangement which would nullify the limitations of former said processes. Further its initial cost is also less. The new evolved concept is a road cleaning machineisoperatedbyhumanpower.Toaccomplish this new idea, the present work is well carried out which is as under. 1. Firstly, the complete market reviewandliteraturesurveybasedontheRoad

Cleaningprocessesbeendone.2.Basedonthedemand power the machine component is designed. 3.Based on obtained designed dimensions the fabrication work of the proposed manually operated road cleaningmachineiscarriedout.4.Atlast,thetesting and trails have been taken to ascertain the load capacity of themachine.

1.1 Objective of Eco-Friendly Road and Floor Cleaner

- Toprovidethealternativemethodforroad cleaning
- To reduce humaneffort
- To save thetime
- To reduce thecost
- To avoid noisepollution

1.2 Literaturesurvey

Mohsen Azadbakht et al 2014 [1] - "Design and fabrication of a tractor powered leaves collector machine equipped with suction-blower system"- The authors explained about the fabricationofleavescollectormachinebytractor powered with suction blower system. He has framed the machine by using chassis, pump, blower, gearbox, hydraulic jack. They concluded total power consumption of that machine is around 14634W.

M. Ranjith Kumar et al 2015 [2] - "Design andAnalysisofManuallyOperatedFloorCleaning Machine"- The authors have been designed and analysed manually operated floor cleaning machine. From his research he concluded the stress level in the manually operated machine is within the safelimit.

Sandeep.J.Meshrametal2016[3]-"Design and Development of Tricycle Operated Street CleaningMachine"–Hehasdevelopedthestreet cleaning machine by tricycle operated. In this research article he framed a model especially for rural area. He concluded that the cleaning isless effective where the street seems to be veryrough anddamaged.

2. Components Used in RoadCleaner

- Pedestalbearing
- Shaft
- Frame
- Rollerbrush
- Chain &sprocket
- Spurgear
- Cyclewheel
- Smallwheel

Scope of the project

Existing road clean methods are two typesi) Electrically operated ii) manually operated. Manualcleaningmaycauseshoulderproblemdue to continuous sweeping. Electrically operated road cleaner's uses electrical energy to run the motor. In our project manually operated road cleaning machine is alternative concept for avoiding such problems. It works veryefficiently withrespecttocoveringarea.Itisveryeconomical touse.

Methodology

1. Literaturesurvey
2. Identification of designparameters
3. Design
4. Analysis
5. Fabrication
6. Testing
7. Result &discussion

Design calculation:

- SprocketfreewheelRatio
  64 teeth ofsprocket
  16 teeth of free wheel
  64/16 = 4
- Spur Gear Ratio
  68 teeth of gear
  18teethofpinion
  68/18 =3.77
- BrushRevolution
  4*3.77=15

1revolutionofcyclewheel=15revolutionofbrush

- Diameter of wheel=62cm
- Radius=31cm
- Circumference=2πr
  = 2π*31
  =194.77cm
- Assuming 50 revolutions of wheel in one minute
  =50*194.77
  =9738.5cm
  =97m

- (Revolutionofwheelinoneminute)*(Brush revolutioninonerevolutionofwheel)
  = 50*15
  = 750rpm

2. PARAMETERS CONSIDER DEVELOPING LOW COST MANUALLY OPERAED SWEEPING MACHINE

1. **Shaft(Axle):**Axleisusedformountingsprocket andwheels.Weusethreeaxlefirstaxleisused fortransmissionpower,secondaxleisusedfor mountingsweeperbrush,andthirdaxleisused for mounting supportingwheels.

   Mildsteelmaterialisselectedforanaxledueto mild steel has a resistance to breakage. Mild steel, as opposed to higher carbon steels, is quite malleable, even when cold this means it has high tensile and impact strength higher carbon steels usually shatter or crack under stress, while mild steel bends or deforms. In some designs, this allows independent suspension of the left and right wheels, and therefore a smoother ride. Even when the suspension is not independent, split axles permittheuseofadifferential,allowingtheleft andrightdrivewheelstobedrivenatdifferent speeds as the automobile turns, improving traction and extending tirelife.

2. **ChainDrive:**Achaindriveconsistsofonendless chain running around two sprocket wheel the chaindrivehasafeaturewhicharecommonto both the gear drives and belt drives. Chain drives are a means of transmitting power like gears, shafts and belt drives. Chain drive is a wayoftransmittingmechanicalpowerfromone place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycleandmotorcycle.Itisalsousedinawide varietyofmachinesbesidesvehicles.Drivebelts can slip unless they have teeth, which means thattheoutputsidemaynotrotateataprecise speed,andsomeworkgetslosttothefrictionof thebeltasitbendsaroundthepulleys.Wearon rubber or plastic belts and their teeth is often easier to observe, and chains wear out faster thanbeltsifnotproperlylubricated.

3. **ChainDrive:**Achaindriveconsistsofonendless chain running around two sprocket wheel the chaindrivehasafeaturewhicharecommonto both the gear drives and belt drives. Chain drives are a means of transmitting power like gears, shafts and belt drives. Chain drive is a wayoftransmittingmechanicalpowerfromone place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycleandmotorcycle.Itisalsousedinawide varietyofmachinesbesidesvehicles.Drivebelts can slip unless they have teeth, which means thattheoutputsidemaynotrotateataprecise speed,andsomeworkgetslosttothefrictionof thebeltasitbendsaroundthepulleys.Wearon rubber or plastic belts and their teeth is often easier to observe, and chains wear out faster thanbeltsifnotproperlylubricated.

Table -2.1: components and material of eco-friendly road and floor cleaner

Components	Material
Cycle wheel	steel
Small wheel	plastic
Roller brush	plastic
Chain, sprocket	Steel
Brush ratio	1:15
Gear ratio	1:3.77
Sheet for bin	GI sheet
Square pipe	Mild steel
Rod	Mild steel
Pedestal bearing	Cast iron
Spur gear	Steel

3. Design

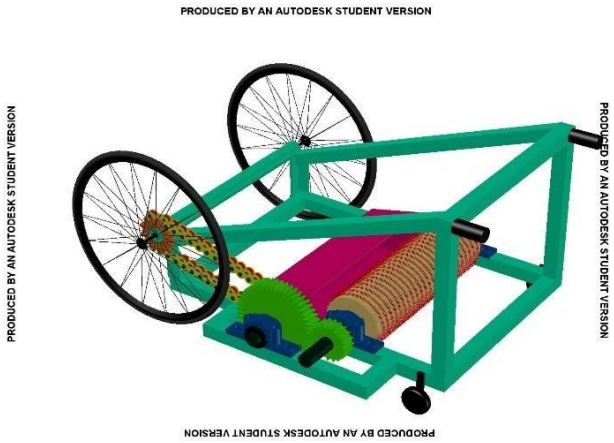

Fig.3.1 Designofeco-friendlyroadandfloor cleaner.

Eco friendly road cleaning machine is an advanced type of machine used for theroads or street. The machine is run by a human effort or man power. The systen is fixedwith pair of wheel which are connected with the help of shaft. The shaft makes the wheel connectedtooneother.Thewheelaremoved for a desired position with a help of manual forcewhichcanhandletomove.Achaindrive is connected to the wheels and gear at one side. The chain is moved according to the wheel and gear. The brush moving opposite direction of the wheels move and the brush brooms the waste present on the road also it dumpsthewasteintothewastecollectingbox. Thewastecollectingboxisremovedtodump the waste into desiredplace.

In this work components used as given below

1. **Cyclewheel:**
   A cycle wheel use for movement of our machine. Use two wheels each wheel having diameter of609.6mm.

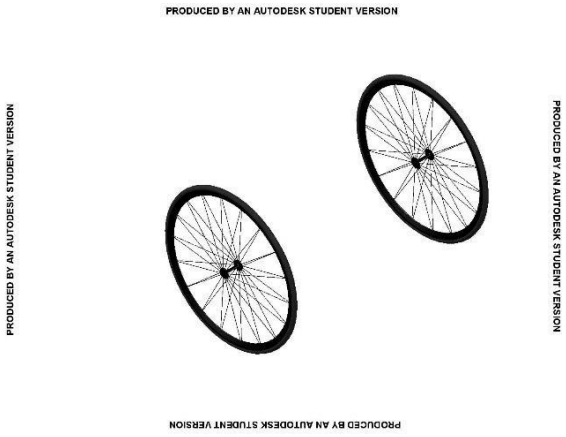

Fig.3.1(a) cycle wheel

2. **Supportingwheel**

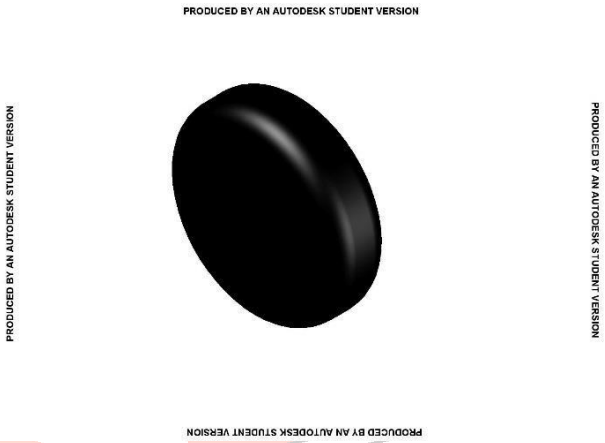

Fig.3.1(b) supporting wheel

Diameterofwheel60mm.Itisuseformovement ofmachine

3. **Sprocket**

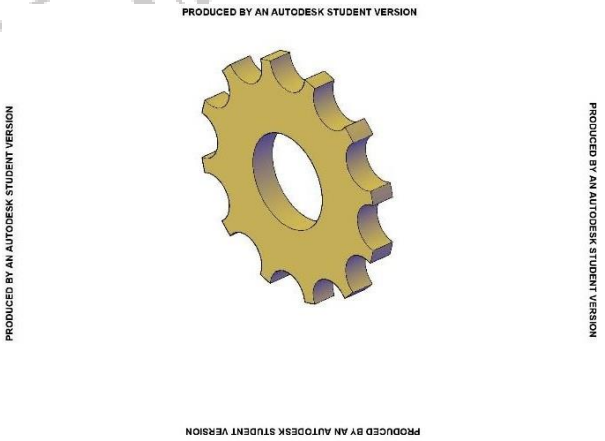

Fig.3.1(c) sprocket

It is use for transmitting power from wheel to secondary sprocket to brush. It has outer diameter is 150mm & 44 teeth.

4. Rollerbrush

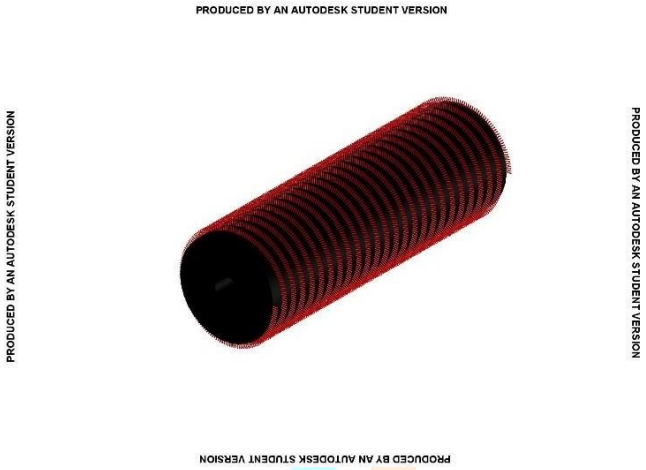

Fig.3.1(d) Roller brush

Rollerbrushhavingalengthoflengthof900mm longandouterdiameterof250mm.

5. Spurgear

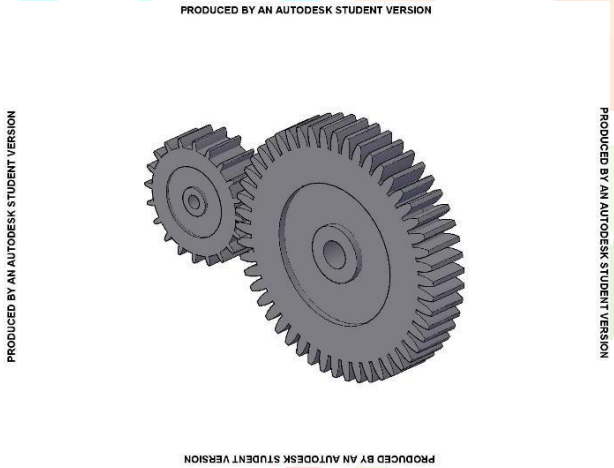

Fig.3.1(e) spur gear

Usetwogeardriveranddriventhesmallgearhas a diameter of 36mm and larger gear having a diameter of 120mm and 64teeth.

6. Pedestalbearing

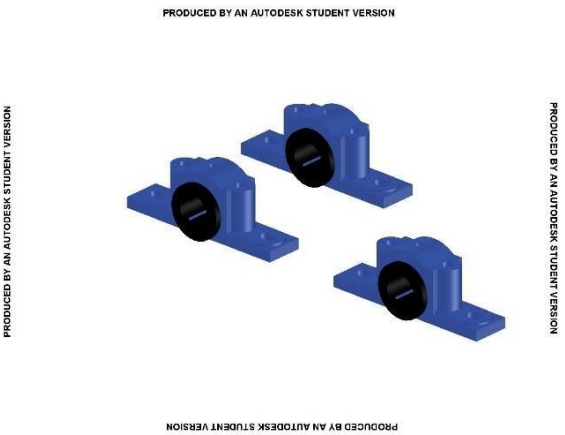

Fig.3.1(f) pedestal bearing

Itisusedtosupportforarotatingshaftwith the help of compatible bearing and various accessories.Itsinnerdiameteris25mm.

7. CollectingBox

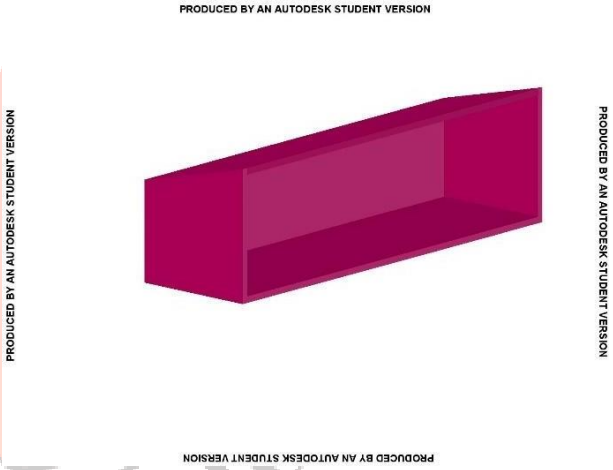

Fig.3.1(g) collecting box

Thefunctionofthecollectingboxistocollectthe waste up to some quantity after that remove box and dump thewaste.

8. Frame

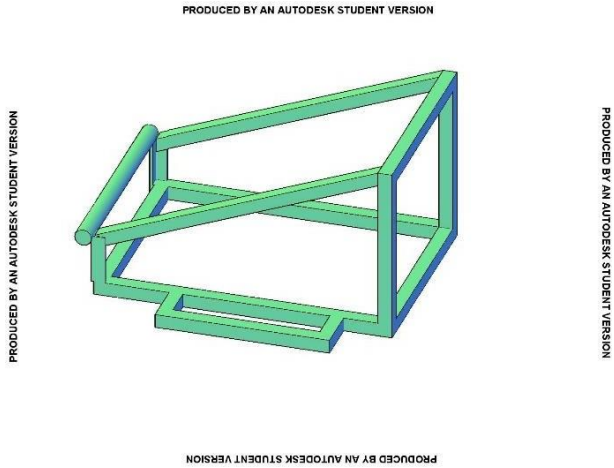

Fig.3.1(h) frame

Frame is the body part on which all the other components are assemble

- Cyclewheel
- Smallwheel
- Pedestalbearing
- Spurgear
- Industrialbrush
- Bin

9. Chain

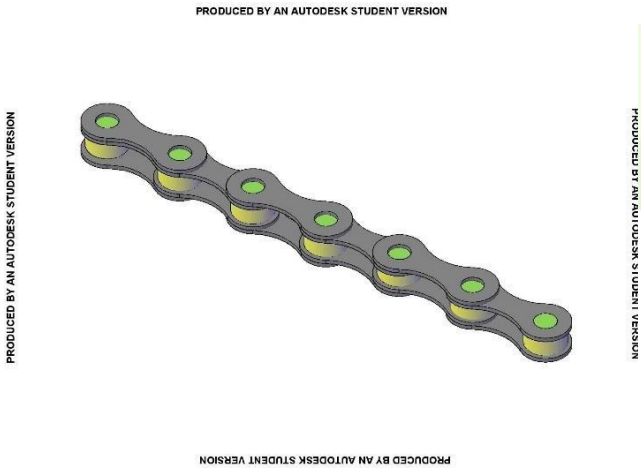

Fig.3.1(I) chain

Roller chain is most used to transmit the power.

4. WORKING PRINCIPLE OF ROAD CLEANING MACHINE

Eco friendly road cleaning machine is an advanced type of machine used for the roads or streets. The detail working of the Eco-friendly Road cleaning machineisexplainedbelowEcofriendlyroadcleaning machine we are making without using any power supply, fuels and engines. The machine is run by a humaneffortoramanpower.Thesystemisfixedwith pair of wheels which relate to the help of shaft. The shaft makes the wheels connected to one and other. The wheels are moved for a desired position with a helpofmanualforcewhichcanhandleisprovidedto move. The handle can be adjusted for a required height and provided three adjusting holes for it. A chaindriveisconnectedtothewheelsandgearatboth sides.Thechainismovedaccordingtothewheeland gear. the brush moving opposite direction of the wheelsmoveandthebrushbroomsthewastepresent on the road also it dumps the waste into the waste collectingbox.Thewastecollectingboxisremovedto dump the waste into desiredplaces

5. ACKNOWLEDGEMENT

We would like to express our deepest sense of gratitude to our project Guide professor pankitkondhiya Assistant professor Mechanical Department forhisconstantsupportandguidancethroughoutthe projectwork.

6. CONCLUSION

The manually operated eco-friendly road and floor cleaner is successfully designed. This project works implementsthemanuallyoperatedeco-friendlyroad cleaner for road cleaning that reducing the cost, humaneffortsaswellastime.Itisthebestalternative for automated road cleaning machine during power crisis. It is found that the existing road cleaning machinesworkswithahumansimpleeffort.Manual cleaning may cause shoulder problem due to continuous sweeping. The manually operated road cleaning machine is alternative concept for avoiding such problems. It works very efficiently with respect to covering area. It is very economical to use. The manuallyoperatedeco-friendlyroadandfloorcleaner can work very efficiently with respect tocovering

area,timeandcostofroadcleaningprocesscompared withtheexistingmachineries.Also,itiseconomical.It wasseenwhiletestingofmachine,thatthecleaningis less effective where the road seems to be very rough and damaged. It can provide job to the uneducated personwhoisinneedforsuchjobsashumanenergy is needed to drive the machine. Maintenance of machine is less, and it is easy to control and clean it having health benefits and it mainly protects environmentpollution.

7. REFERENCES

[1] MohsenAzadbakht,AliKiapey,AliJafari-"Design andFabricationofatractorpoweredleavescollector equipped with suction blower system" - September, 2014Agric Eng Int: CIGR Journal Open access at http://www.cigrjournal.org Vol. 16,No.3.

[2]M.RanjithKumar,N.Kapilan-"DesignandAnalysis of Manually Operated Floor Cleaning Machine" - International Journal of Engineering Research &Technology (IJERT) ISSN: 2278-0181 IJERT IS040912[www.ijert.org]Vol.4Issue04,April-2015.

[3] Sandeep.J.Meshram,Dr.G.D.Mehta-"Designand Development of Tricycle Operated Street Cleaning Machine" - Journal of Information, Knowledge and Research In Mechanical Engineering ISSN 0975 – 668X|Nov15ToOct16|Volume–04,Issue-01.