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Solar Energy Operated Semi-Automatic Floor Cleaning Machine

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Abstract: *This project is capable of performing cleaning of floor and corners effectively, semiautomatic water spray, dry as well as wet cleaning tasks. This floor cleaning machine is designed by keeping the basic considerations for machine and operational cost reduction, efforts reduction, environment friendly and easy handling. The machine will work on electricity. Base of the project is to use renewable energy which is abundant in most of the countries, will have less environmental impact and easy to construct for commercial scale in future. This work can be very useful to improve the life style of mankind. We are basically working on the eliminating the most power consuming unit such as the vacuum cleaning unit, so as to make the project more Deployable in our society by using some basic mechanical cum electrical concepts.*

Keywords*:* renewable energy, environment friendly, floor cleaning machine.

I. INTRODUCTION

Fully automatic and Semi-Automatic machines available in the market are of high ranges and high weights. So, keeping the focus on weight as well as cost, they are not affordable to all such as organization committee of hotels, hospitals, hostels. Hence, there is need to design and develop a floor cleaning machine which is cost effective.In some places such as bus stations, temple halls, byres the floors are not regularly cleaned due to non-availability of machines. There is no machine in the markets which can be used on smooth as well as rough surface floors. Considering weight criteria, machine assembly, handling the machine is very flexible. This machine is affordable to all because of its uses and cost.
In crowdie places such as railway stations floors are not regularly cleaneddue to hectic work of sweepers and non-availability of machines because of this, hygienic environment is not maintained. In India, especially in summer there is power crisis, in majority of places. Hence floor cleaning using floor cleaning machine is difficult without electricity. To overcome this problem, an alternative is made by using solar energy. Considering assembly, weight, handling design machine is flexible. Provision is made for water spraying.
Main mottos of Project are:

- To reduce the human effort and cost.
- To make the environment sanitary and to increase the effectiveness of cleaning.

II. LITERATURE SURVEY

M Ranjit Kumar and N Kapilan et. al [1], The conventional floor cleaning machines is most widely used in airport platforms, railway platforms, hospitals, bus stands, and malls and in many other commercial places. These devices need an electrical energy for its operation and not user friendly.
ShubhamKhade [2], with the advancement of technology, automated floor cleaning machines are getting more attention of researchers to make life of mankind comfortable. The concept is developing in economic countries but the reasons for non-popularity is the design complexity, cost of machines, and operational charges in terms of power tariff. In this paper, a floor cleaning machine is proposed.
Ritvick Ghosh[3], This work elaborates the design and fabrication of a floor cleaner which runs purely on mechanical power and also has the capability of being ridden at low speeds by the user. The mechanism used to drive the cleaning mechanism would be similar to the one used in a spinning mop commonly known as a magic mop. The mechanism

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works using a bevel gear system wherein high speed multiplications can be obtained using the right gear specifications. The input to the system would be in the form a foot-pedal accessible to the user.

Sandeep J. Meshram and DrG.D.Mehta et. al [4], This work presents the design and fabrication of Tricycle operated street cleaning machine with the related search. At present we have few automated machines which are foreign made and can be used in our country. This basically instigates to thing for an alternative mechanism called Street cleaning process.

III. PROPOSED METHODOLOGY

3.1 Problem Identification

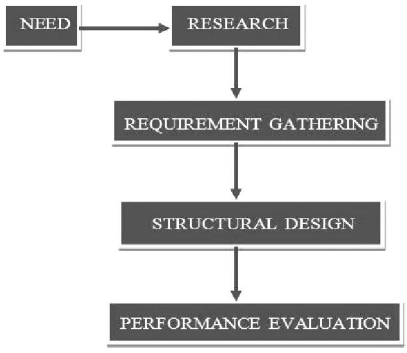
The major problem which India faces is cleanliness. The problem we came across was cleanliness on roads, pathways, lanes, highways, railway stations airports etc. The dust and dirt on the road as well as metal and other pieces on the floor are a problem for the humans.

3.2 Project Objective

- A manually operated floor cleaning is developed with major list of objectives,
- To achieve simultaneous dry and wet cleaning in a single run.
- To make the machine cost effective. Easy to operate.
- Requires no training to operate.
- Lower Maintenance Cost.

IV. DESIGN METHODOLOGY AND FABRICATION

4.1 Design Methodology



4.2 Design Calculation

1. Selection of the roller brush from the standard catalog.

Brush Standard Diameter	100 mm, 115 mm, 125 mm. (Also can be made as per your request)
Standard Length	300,450,600,900,1000,1200,1500,1800. Mm (Also can be made as per your request)

Figure 4.1: Roller specification

Diameter=115mm.....From manufactures Catalog [7]
Length=450mm
Weight=1.25 kg each.

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2. Torque requirement and selection of motor

Coefficient of friction in between brush and roller = 0.8
Load on the Rollers =2.5 kg and diameter of Roller = 0.115m
Torque required= F x R = (0.8 x 2.5 x 9.81) x 0.0575 = 1.12815 N-M
Load on middle Roller =3 kg.....(Dry Run) and 5 kg.....(Wet Run).
Torque required= F x R = (0.8 x 3 x 9.81) x 0.0575 = 1.35378 N-M
Total Torque required for all rollers =3.61008 N-M.
Formula P= 2*3.1415*NT / 60
p =113.41 watt....Dry Run
p =141.76 watt....wet Run
Where,
P= Power
N= Speed in RPM
T = Torque
250 watt DC motor torque = 21 N-M at 300 RPM.
Hence, here 250 watt DC motor at 300 RPM can be used.

3. Selection of Chain No.

Chain No. selection from power rating chart.

Table 14.2 *Power rating of simple roller chain*

Pinion speed (rpm)	*Power (kW)*								
	06 B	*08A*	*08 B*	*10A*	*10 B*	*12A*	*12 B*	*16A*	*16 B*
50	0.14	0.28	0.34	0.53	0.64	0.94	1.07	2.06	2.59
100	0.25	0.53	0.64	0.98	1.18	1.74	2.01	4.03	4.83
200	0.47	0.98	1.18	1.83	2.19	3.40	3.75	7.34	8.94
300	0.61	1.34	1.70	2.68	3.15	4.56	5.43	11.63	13.06
500	1.09	2.24	2.72	4.34	5.01	7.69	8.53	16.99	20.57
700	1.48	2.95	3.66	5.91	6.71	10.73	11.63	23.26	27.73
1000	2.03	3.94	5.09	8.05	8.97	14.32	15.65	28.63	34.89
1400	2.73	5.28	6.81	11.18	11.67	14.32	18.15	18.49	38.47
1800	3.44	6.98	8.10	8.05	13.03	10.44	19.85	—	—
2000	3.80	6.26	8.67	7.16	13.49	8.50	20.57	—	—

Figure 4.2: Chain power rating

so, chain useful for purpose is 08B

European Series –
ISO 606/ BS 228/ DIN 8187

Intl. Ref. No.	Diamond Chain No.	Pitch P.	Width between Inner Plates W (Min)	Roller Dia. D (Max)	Bearing Pin Dia. d (Max)	Plate Height H (Max)	Width over Bearing Pin A (Max)	Width over Joint Fastness B (Max)	Projected Bearing Area (sq.cm)	Arrange Weight Par Metre (Kg)	Tensile Strength (Kgf) (Min)	Spares Avail -ability
04B-1	D048 01	6.00	2.80	4.00	1.85	5.00	7.40	10.30	0.08	0.12	300	A,B,C,D
05B- 1	D058 01	8.00	3.00	5.00	2.31	7.10	8.60	11.70	0.11	0.18	510	A,B,C,D
06B- 1*	D061 01	9.525	5.72	6.35	3.28	8.20	13.50	16.80	0.28	0.40	920	A,B,C,D
08B- 1	D083 01	12.70	7.75	8.51	4.45	11.80	17.00	20.90	0.50	0.68	1640	A,B,C,D
10B- 1	D101 01	15.875	9.65	10.10	5.08	14.70	19.60	23.70	0.67	0.91	2250	A,B,C,D
12B- 1	D120 01	19.05	11.00	12.07	5.72	18.10	22.70	27.50	0.88	1.12	2960	A,B,C,D

Figure 4.3: Chain specification from manufactures catalog

So, From Manufactures catalog [6] chain has specification as =Pitch is 12.70 mm,
Roller diam. is 8.51 mm, Roller width is 7.75 mm.

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Now,
Number of links in chain (Ln)

$$L_n = 2\left(\frac{a}{p}\right) + \left(\frac{z_1 + z_2}{2}\right) + \left(\frac{z_2 - z_1}{2\pi}\right)^2 \times \left(\frac{p}{a}\right)$$

where,
a = centre distance between axes of driving and driven sprockets (mm)
z1 = number of teeth on the smaller sprocket
z2 = number of teeth on the larger sprocket
Here, centre distance between axes of driving and driven sprockets is 240 mm and
z1=z2=14
so, Ln = 52 mm..... Ln = number of links in the chain.
Now
L = L = Ln * p ..... length of the chain (mm)
L = 52 * 12.70
L = 660.4 mm = 60.4 cm.
Now for centre distance between axes of driving and driven sprockets is 470 mm and
z1=9, z2=14
Ln = 86 mm
L = 1092.2 mm = 109.22 cm.

$$\text{kW} = \frac{P_1 v}{1000}$$

where,
P1 = allowable tension in the chain (N)
v = average velocity of chain (m/s)
So, First calculate velocity

$$v = \frac{zpn}{60 \times 10^3}$$

For, z = 14, pitch = 12.70 mm and 300 RPM
v = 0.889 m/s
Now, Allowable tension in the chain (N)
P1 = 278.89 N

4. Selection of Chain sprocket
a = 360/z
Where a is called the pitch angle and z is the number of teeth on the sprocket.
a = 360/14 = 25.714
where D is the pitch circle diameter of the sprocket.
so D = 57.07 mm

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SPROCKETS 1/2" X 5/16"

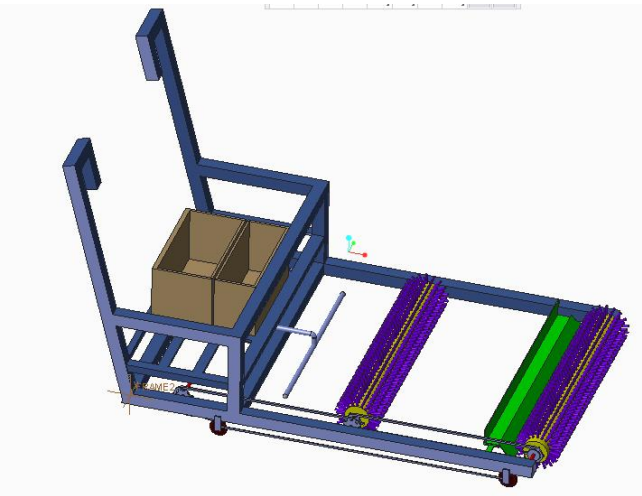
z	d_e	d_p	SIMPLEX			DUPLEX			TRIPLEX		
			d_m	D_1	A	d_m	D_1	A	d_m	D_1	A
8	37.2	33.18	20	10	25	20	10	32	20	10	46
9	41.0	37.13	24	10	25	24	10	32	24	12	46
10	45.2	41.10	26	10	25	28	10	32	28	12	46
11	48.7	45.07	29	10	25	32	12	35	32	14	50
12	53.0	49.07	33	10	28	35	12	35	35	14	50
13	57.4	53.07	37	10	28	38	12	35	38	14	50
14	61.8	57.07	41	10	28	42	12	35	42	14	50
15	65.5	61.09	45	10	28	46	12	35	46	14	50
16	69.5	65.10	50	12	28	50	14	35	50	16	50
17	73.6	69.11	52	12	28	54	14	35	54	16	50

V. ADVANTAGES

- User friendly, requires less human efforts.
- Less maintenance.
- Cost effective portable.
- Every part is bolted, hence it has more flexibility.
- One machine can do dry cleaning and wet cleaning.

VI. FUTURE SCOPE

- To attach a tilting rubber pad for improving mopping work.
- To make available another charging medium.
- To make it more compact and to fabricate it at level of household purpose.



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