

Design and Assembly of Prototype of Automatic Rail Track Cleaning Machine

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Abstract - This paper aims to present a prototype for a cost efficient Railway track cleaning machine which would prove to be a wonderful alternative to the current system in place if implemented. The proposed prototype will be designed to overcome all the disadvantages of the current machine, and would help materialize the idea of super clean railway tracks across the nation. Our main focus lies on simplifying the process of cleaning as much as possible, since tracks are to be cleaned frequently. This prototype will be designed to remove waste (plastic covers, paper cups, polythene covers etc.) and store it in a separate cabin which would enable removal of all the wastes at once.

Key Words: Suction pump, DC motor, Brush roller, Wastage collector, Water tank, nozzle, etc.

1. INTRODUCTION

India is travelling towards the dream “clean and green”. Mere words create no impact on people. Preaching by action is our motto; our railway track cleaning machine keeps the railway track and its surroundings clean. This will motivate people to keep the city clean which will in turn help build a clean nation. Railway track cleaning machine is designed to provide the best cleaning facility with minimum power consumption and labour power. In view of promoting Swachh Bharath Abhiyan, we have come up with this cost and power efficient prototype. A railway, by virtue of being a public transport system, are used by myriads of people and is thus littered frequently. Our main focus lies on simplifying the process of cleaning as much as possible, since tracks are to be cleaned frequently. This prototype is designed to remove waste (plastic covers, paper cups, polythene covers etc.) and store it in a separate cabin which would enable removal of all the wastes at once. The tracks, can then be cleaned with water at high pressure, with the latter composed of an equal amount of disinfectant and pleasant smelling liquid. Apart from cleaning the tracks, waste accumulated on the sides of the tracks can also be removed using the proposed prototype. A Brush roller is attached at the centre of this compartment which facilitates to remove sticky adhesive wastage from floor area.

2. SYSTEM DESIGN AND METHODOLGY

2.1 Proposed Methodology

Our main focus lies on simplifying the process of cleaning as much as possible, since tracks are to be cleaned frequently.

This prototype is designed to remove waste (plastic covers, paper cups, polythene covers etc.) by using wastage collector and store it in a separate cabin which would enable removal of all the wastes at once. The dry waste cleaning by using collector and wet waste remove by brush roller and cleaning by high suction pressure. The tracks can then be cleaned with water at high pressure, with the latter composed of an equal amount of disinfectant and pleasant-smelling liquid.

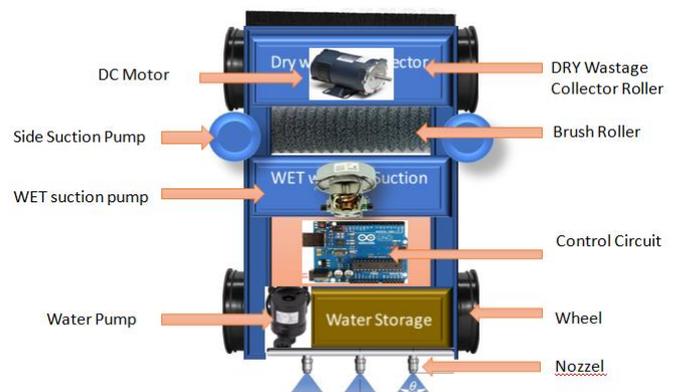


Fig -1: Layout of Prototype

3. Hardware Implementation

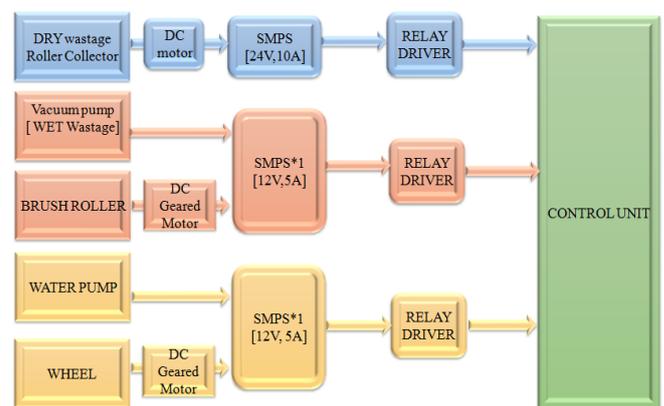


Fig -2: Block Diagram

3.1 Vacuum Cleaner

A motor is attached to a centrifugal fan with angled blades. As the fan blades turn, they force air forward toward the exhaust port. When air particles are driven forward, the density of particles (and therefore the air pressure)

increases in front of the fan and decreases behind the fan. The pressure level in the area behind the fan drops below the pressure level outside the vacuum cleaner (the ambient air pressure). This creates suction, which is a partial vacuum, inside the vacuum cleaner. The ambient air pushes into the vacuum cleaner through the intake port because the air pressure inside the vacuum cleaner is lower than the pressure outside.

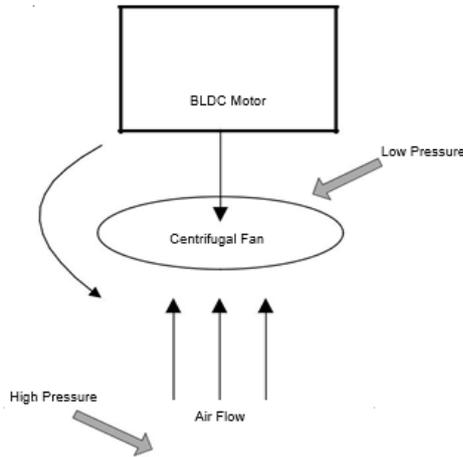


Fig -3: Suction principle

As long as the fan is running and the passageway through the vacuum cleaner remains open, there is a constant stream of air moving through the intake port and out of the exhaust port.

3.2 Cylindrical Brush Roller

Nylon filled cylinder brushes are commonly used in many applications for scrubbing, dusting, and cleaning conveyed objects or conveyor belts. Some common applications include bakery and food conveyors, plating processes, lumber mills, block and brick manufacturing, and other conveyor cleaning applications. Cylindrical nylon brushes offer the following characteristics in most applications: excellent fatigue life, good abrasion resistance, low to moderate absorption of water (3% to 9%), an excellent bend recovery rate, resistance to most common solvents, and suitability for use in weak acids.

3.3 DC Motor

Powerful brushed DC Motor that serves as a replacement for the heavy industrial worm drive motor. But is a fully capable as a straight DC Motor with a lot of power. Continuous rated motor, suitable for a wide range of applications.

Table -1: Specification of Motor

Sr. No	Parameters	Rating
1	Voltage	12-24V DC
2	Watt	400
3	Speed	1400

3.4 SMPS

Switch mode power supplies (SMPSs) are used in a range of applications as an efficient and effective source of power. This is in major part to their efficiency. For anybody still working on a desktop, look for the fan output in the central processing units (CPU). That's where the SMPS is. SMPS offers advantages in terms of size, weight, cost, efficiency and overall performance. These have become an accepted part of electronic gadgets. Basically it is a device in which energy conversion and regulation is provided by power semiconductors that are continuously switching "on" and "off" with high frequency.



Fig -4: Suction principle

Specifications

- Output: 12V, 10Amp
- Input: 180V to 260V AC, 47 to 63Hz
- LED power indication
- DC calibration range: +/-10% of the output voltage
- Short Circuit protection: long term
- Setup time: Less than 1 second
- Hold-up time: greater than 20mS
- Operating temperature: 0 to 450C
- Operating Humidity: 20% to 80% Non condensing (very important)
- Power conversion efficiency: 80%
- Dimension: 200 x 98 x 40mm
- Product weight: 625gms

4. TEST Analysis

The result of this model were obtained prototype collect the wastage (plastic covers, paper cups, polythene covers etc.) through roller collector in tank. At end of compartment water sprayed on track through highly pressurized nozzle. And this prototype were move forward and reverse direction on track though control of Aduino based system.

5. CONCLUSIONS

In this paper, this prototype is presented for efficient cleaning purpose. This prototype suits almost all climatic conditions. This compartment can be made standalone and can be engineered with extremely low cost communication techniques to work without any external engine. A prototype of the rotating brush device is made manually to ensure the cleaning effect of the proposed system. It can be easily controlled and operation will be simple. It will be more efficient to railway track cleaning for economical condition as well as technically.

REFERENCES

1. B.L. Thereja, A.K. Thereja, "Electrical Technology", Volume-2, S Chand Publication, DC Motor: Characteristics:996-1022, Speed control:1030-1077.
2. Sang-hun Kim,, "Electric Motor Control: DC, AC, and BLDC Motors" ISBN: 2978-012-812-53, PP: 39-93
3. Amit Mundada , Jagdeesh S, "Railway Track Cleaning Machine" Worked on track cleaning machine,
4. Mr. Perry S. Bagley, United States on Tool System with Replaceable Heads and Offset Handle US 20110113577A1 [For Representative purpose only]
5. Prof. Ms. Swati Pawar, Naman Aggarwal, Piyusha Chaudhari, Akshay Mahalkar, Anshul Mishra, IJRE | Vol. 03 No. 05 | May 2016
6. <http://www.nr.indianrailways.gov.in>
7. <http://www.rcf.indianrailways.gov.in>