

Design of trash compactor using vacuum and compressor

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December 2019

1 Introduction/Motivation

India is a very big and populated country and with its increasing population daily waste generation rate is also increasing in the country mainly in urban areas. Over 377 million urban people live in 7,935 towns and cities and generate 62 million tones of waste per annum. Only 43 millions tonnes of waste is collected, 11.9 million tonnes is treated and 31 million tonnes is dumped in landfills. About 1,250 hectors of land needed to dump India's solid waste every year. And due to unorganized dumping of the waste landfills require more land.

The idea is to design a machine which can convert waste product into the some solid shapes by compressing it, which allow us to store more garbage in the same landfill area. This machine will stuck the garbage by the use vacuum suction pump and presses it into some solid or cubical shapes with the help of hydraulic press. These small solid shapes of garbage can be easily organized and store in landfills occupying less space.

2 Market Research/Literature Survey

Pre-landfill waste compaction is often beneficial, both for people disposing of waste and the company collecting it. This is because waste collection companies frequently charge by volume or require use of standard-volume containers, and compaction allows more waste to fit in the same space. Trash compactors are available for both residential and commercial use. Compacting garbage after it is collected allows more waste to fit inside the collection vehicle, meaning fewer trips to a dump or transfer stations are required. The collection company also incurs lower landfill fees, if the landfill charges by volume [3].

There are various kinds of garbage compactor available for the better use and implementation of the waste reduction techniques. Some of the most famous kinds are a pneumatic garbage compactor and hydraulic garbage compactor. On comparing hydraulic powered garbage compactor and pneumatic powered

garbage compactor, the efficient version of the garbage compactor is the hydraulic compactor. The functioning of the hydraulic compactor is on Pascal's principle of pressure. These garbage compactors make use of the centrifugal force, extra down pressure and the necessary vibration to crush the waste materials. These reduce the waste materials to finer components or sheets to generate the desired results [4].

3 Hardware Implimentation

The following are the hardware required for the project.

1. Aluminium metal sheets
2. Battery
3. Fan
4. Motors
5. Hydraulic bottle jack
6. Bolts, nuts, levers and clamps
7. Springs
8. Wires and Switches
9. Wheels
10. Metal bars
11. Infrared sensor
12. Microcontroller (NODEMCU)
13. Solar plates

4 Software Requirement

1. Arduino (IDE)

5 Implimentation

This machine is based on the principle of flow of air from area of high pressure to area of low pressure i.e. a vacuum suction pump. An electric motor is attached to a fan that spins it at high velocities. The fast spinning of fan creates a low pressure region inside the suction hose of the vacuum suction pump. After collection of the waste or garbage, it will be collected in compressing chamber where a hydraulic press will press the garbage or waste into compressed solid shapes and will dispose it in the ground from automatic sliding door downward. The electric motor and hydraulic press will be powered by a battery and infrared sensors will be mounted in the compression chamber to measure the garbage level in the compressor chamber. Device will also have solar panels mounted on the front of the chamber connected to the battery.

6 Block Diagram

The machine consists of three major operation- suction of garbage, collection of garbage and compression of garbage.

Collection of garbage (Suction of garbage is based on the principle of vacuum suction pump. In this device a dc motor will be mounted on the chamber wall which will have an exhaust fan. DC motor (12 volts) will be powered with a battery. Fan will rotate at very high speed (3500-600 rpm) and will create low pressure zone in the chamber that will suck the garbage from high pressure zone i.e. roads or dumping ground. Suction power will be controlled by controlling the speed of motor using speed regulator.)

Collection of garbage (The sucked garbage will be collected in the chamber that is separated from the vacuum chamber with the help of a net. The chamber will have a separate box in the lower portion of the chamber in which the garbage will be collected for the further operation. The collection chamber will also consist of IR sensor which will detect the level of garbage in the chamber.)

Compression of garbage (Compression of garbage will be achieved by the help of a hydraulic press. The hydraulic press will be made by using a bottle jack which will be manually operated by the user. The hydraulic press will apply the load of 5-7 tonnes. The user will operate the hydraulic bottle jack with the help of a lever, after compression a spring mechanism will make the press come to initial position. After compression the garbage will be converted into small solid shape and will be removed by an opening in the chamber later it can be easily stored or transported.)

User Interface: (This device can be easily operated by any individual. It will have a display panel on the top of the chamber which will have ON/OFF

switch, garbage level indicator and a speed regulator. This device will have movable wheels at bottom so that it can be easily moved from one place to another.)

diagram.jpg

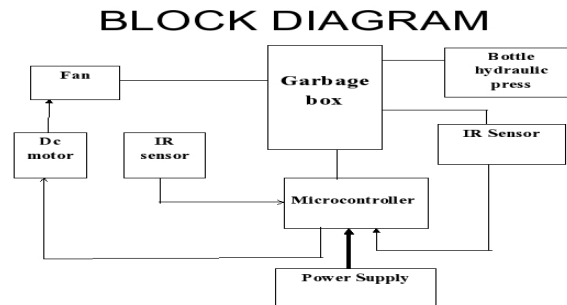


Figure 1: Block Diagram

7 Flow Chart

This is the flow chart of the given device.It shows the working of device

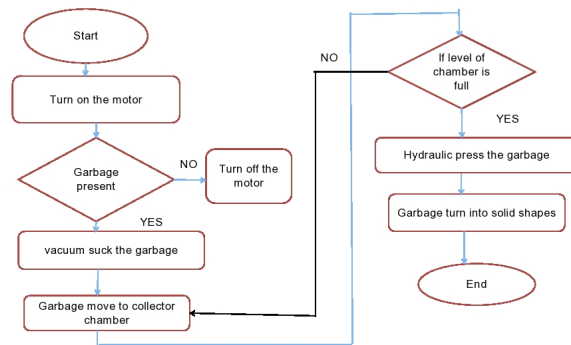


chart.jpg

Figure 2: Flow Chart

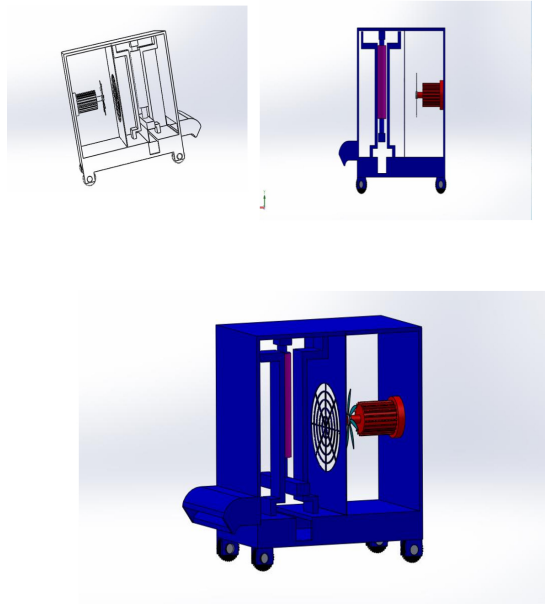
8 Fesability

The current waste management practice in India involves collecting waste from sources through a community collective bin system, after which it gets transported to a low-lying landfill system with intermediate processing of Municipal Solid Waste (MSW). The open dumping practice is leading to various problems like pollution and health hazards. Both surface and groundwater are affected by this; in fact, groundwater is in a critical state. Current procedures are not ideal, hence, the solid waste management crisis [5].

So we are trying to simplify this process with the help of automatic garbage collection from the source and to convert it into some desirable shape so that more garbage can be collected at same time and will also help to reduce and organize the garbage in the landfills and dumping ground. It will be an effective method to organize daily waste not only for the government but also helpful for the private sectors such party planners, event organizers and some industries also. This device has a market scope for the those industries and private sectors who have mass waste generation as it will provide easy and low cost disposal of the waste.

9 3D-Model

3D MODEL



10 Conclusion

This device has two mechanical parts in which we completed one with its fabrication and the testing will be done, after that we will proceed to next fabrication of the main casing and vacuum suction pump.

11 References

- [1]jain,R.K(2012)Production technology,17 Edition,Khanna Publisher,New Delhi,806-824 [2]Sharma,P.C.(2005)A Textbook of Production Engineering.10th Edition,S.Chand and company Ltd,New Delhi,69-146 [3]Design and Fabrication of a Manually Operated Hydraulic Press [4]en.Wikipedia.org/wiki/Waste_management_in_India[5]*timesofindia.indiatimes.com*
hectares-needed-to-dump-indias-solid-waste-every-year/articleshow/66093408.cms