Auto-Balancing Quad copter

**Project By**

**Siddharth Kulkarni**

**Aditya Gothe**

**Kshtij Ghanekar**

**Gaurav Parate**

**Yash Vishwakarma**

**Email:** [**punesiddharth@gmail.com**](mailto:punesiddharth@gmail.com)

**Technical Support by**

D-I-Y lab of Vigyan Ashram, Pabal

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**INTRODUCTION-**

In India, 120,000 tones [1] of garbage get generated every- day. Pune produces approx 1300 ton (13 lacks Kg) of garbage every day. On an average approx 0.5kg of garbage is produced per person per day. About 46% by volume of this garbage is dry garbage and remaining 54% is wet garbage. Wet garbage consists of mainly organic waste and it can be decomposed. Dry garbage if kept clean can be recycled. But people habitually mix the dry and wet garbage. The rag pickers have to manually segregate the garbage. They need to manually clean it. This process is very hectic and causes health problems for them. Some of the material viz small chocolate wrappers and polythene bag remains as it is. It creates water clogging problems and health and cleanliness issue.

Pune Municipal Corporation (PMC) asked citizens to segregate dry and wet garbage at home itself. They are organizing awareness campaign to segregate waste. But still it is observed that dry and wet garbage gets mixed.

Transportation of garbage is taking place in the following way:--

**Home 🡪 Society 🡪 Municipal garbage collection van 🡪 Garbage depot**

The garbage need to be stored separately at each of the above step. Failure at any place results in mixing of the garbage.

My observation in our society is as follows:

1. People kept dry and wet garbage separately at home.
2. Society sweeper collects it from every house. He finds it difficult to carry two separate big drum to collect wet and dry garbage from all houses of society. Therefore many times he mixes the wet and dry garbage in one drum.
3. Even if he takes them separately, it was observed that the collection van is getting overflowed and hence municipal workers also dump the wet and dry garbage while transporting.

The project is undertaken to find out solution to mixing of dry and wet garbage problem.

**OBJECTIVE-**

To find solution to avoid mixing of dry and wet garbage.

**IDEA/PROPOSED SOLUTION-**

My idea is based on following of my observations -

1. Dry garbage is bulky in size. It can be compressed and its volume can be reduced.
2. Dry garbage cannot get decomposed. It does not stink. Hence it can be stored for longer period.

To solve this problem I thought of creating a mechanism that will reduce the volume of the dry garbage. This dry garbage can be stored at home for a week. It can be transported on weekly basis to garbage depot. Since wet garbage cannot be stored, it will be collected daily. It can be directly used for decomposing and thereby reducing labour of the rag pickers. We can recycle maximum dry garbage since it does not get spoiled with wet garbage.

To store the dry garbage at home for a week, my idea is to design a dustbin which can compress dry garbage and store it in a less space.

**For six day in a week**

Home (Store Wet garbage every day, Dry garbage in new dustbin) 🡪 Society worker (Daily collect wet garbage only) 🡪 Municipal van (Daily collect wet garbage only) 🡪 Garbage depot 🡪 for composting

**For Seventh day in a week**

Home (Only dry garbage) 🡪 Society worker (Only collect dry garbage) 🡪 Municipal van (Only collect dry garbage) 🡪 for recycling

**EXPERIMENT-**

**1] Determining quantity and volume of dry garbage per family**

To find how much dry garbage is generated per family, I have decided to collect dry garbage of one week from 10 families.

1. Sept 2014: I have collected the garbage for a week from my house.
2. Oct 2014: Then I have collected dry garbage of 10 families from our society for a week.
3. I have calculated its weight and volume per family. I have presented the data in MS Excel. It is as follows-

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sr.no.** | **Date** | **No. of days** | **Name of the Family** | **No. of person in family** | **V1** |
| 1 | 9/9/14 to 15/9/14 | 8 | Purohit | 5 | 2714.6 cm3 |
| 2 | 10/9/14 to 17/9/14 | 8 | Sheety | 4 | 3081.6 cm3 |
| 3 | 10/9/14 to 17/9/14 | 8 | Gantellu | 5 | 3443.5 cm3 |
| 4 | 10/9/14 to 17/9/14 | 8 | Warwatkar | 4 | 1910.3 cm3 |
| 5 | 10/9/14 to 17/9/14 | 8 | Kulkarni | 3 | 3016.2 cm3 |
| 6 | 10/9/14 to 17/9/14 | 8 | Bhirangi | 3 | 3066.5 cm3 |
| 7 | 10/9/14 to 17/9/14 | 8 | Ladkat | 5 | 2940.8 cm3 |
| 8 | 10/9/14 to 17/9/14 | 8 | Bhide | 3 | 2287.3 cm3 |
| 9 | 10/9/14 to 17/9/14 | 8 | Jagadale | 5 | 1377.4 cm3 |
| 10 | 10/9/14 to 17/9/14 | 8 | Nerlekar | 5 | 2573.8 cm3 |

**DESIGNING DUSTBIN-**

Dustbin is designed after a lot of brainstorming and by considering following criteria:

1. Cost
2. space required
3. easy for handling
4. Aesthetic

Following designs were made to make prototype.

**Cylindrical Dustbin->**

Garbage

Piston to push garbage

Garbage window

Pvc pipe for compressing the garbage

**Frustrum Cone-**

Outlet to remove compressed garbage

Garbage window

Piston to push garbage

Pvc pipe for compressing the garbage

**PROTOTYPING-**

I fixed the model of dustbin as per the traditional size dustbin, but I got an idea to design a dustbin like a PVC pipe which would reduce the space required for the dustbin. Thus, with the help of some of my friends, I have created a dustbin (like the traditional dustbin) by using the following tools and material-

1. Grinder
2. Drilling Machine
3. Handsaw
4. Pipe
5. Dustbin
6. Hinge
7. Screw

List of material used and costing:

1. **Cylindrical Dustbin**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sr.no | Details | Quantity | Rate 12.png | Amount 12.png |
| 1 | Pipe | 2 | * 15 | * 30 |
| 2 | Hinge | 1 | * 7 | * 7 |
| 3 | Screw | 7 | * 1 | * 7 |
|  |  |  | TOTAL | * 40 |



Figure 1 Dust bin 1: Cylindrical Figure 2 Dust bin 2: Frustrum cone

1. **Frustrum cone dustbin**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sr.no | Details | Quantity | Rate | Amount |
| 1 | Screw | 7 | * 1 | * 7 |
| 2 | Dustbin | 1 | * 60 | * 60 |
| 3 | Hinge | 1 | * 5 | * 5 |
| 4 | Pipe | 1 | * 7 | * 7 |
|  |  |  | TOTAL | * 72 |

**TESTING OF THE DUSTBIN-**

I have used the dustbin for storing and compressing the dry garbage collected from 10 families one by one. And found out the volume reduced and thus checked the feasibility of idea. I put the data in an excel sheet It is as follows-

**A] Cylindrical Dustbin-**

**Before Compression-**

Volume available for storage of the dustbin (Cylindrical): 3367.79 cm3

[2]**Volume of Cylindrical Dustbin=Height\*Area of the base of the Dustbin**

**L1=8cm, L2=75cm, r = 4cm**

Area of the base=Л\*r2 --- r---

H=L2-L1 H

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sr.no.** | **Date** | **No. of days** | **Name of the Family** | **V1 (Before compression)** | **V2 (After compression)** | **% reduction in volume** |
| 1 | 9/9/14 to 15/9/14 | 8 | Purohit | 2714.6 cm3 | 1136.1 cm3 | 58.14 |
| 2 | 10/9/14 to 17/9/14 | 8 | Sheety | 3081.6 cm3 | 2116.4 cm3 | 31.32 |
| 3 | 10/9/14 to 17/9/14 | 8 | Gantellu | 3443.5 cm3 | 1231.6 cm3 | 64.23 |
| 4 | 10/9/14 to 17/9/14 | 8 | Warwatkar | 1910.3 cm3 | 1030.5 cm3 | 46 |
| 5 | 10/9/14 to 17/9/14 | 8 | Kulkarni | 3016.2 cm3 | 1860 cm3 | 38.3 |
| 6 | 10/9/14 to 17/9/14 | 8 | Bhirangi | 3066.5 cm3 | 1156.2 cm3 | 62.29 |
| 7 | 10/9/14 to 17/9/14 | 8 | Ladkat | 2940.8 cm3 | 1432.7 cm3cm3 | 51.28 |
| 8 | 10/9/14 to 17/9/14 | 8 | Bhide | 2287.3 cm3 | 779.19 cm3 | 65.93 |
| 9 | 10/9/14 to 17/9/14 | 8 | Jagadale | 1377.4 cm3 | 854.59 cm3 | 37.95 |
| 10 | 10/9/14 to 17/9/14 | 8 | Nerlekar | 2573.8 cm3 | 854.59 cm3 | 66.79 |

**Average reduction in volume in cylindrical Dustbin = 53 %**

B] **Frustrumcone Dustbin-**

**Before Compression-**

**Volume of Frustrumcone Dustbin**[3] **=**

r

R1

Height of the dustbin

Height of the rod left upward

**r=19, R1=22**

Volume =26438.8 cm3

Height = 20

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr.**  **no.** | **Date** | **No. of days** | **Name of the Family** | **V1** | **V2** | **v1-v2** | **Reduction in volume** |
| 1 | 21/9/14 to 28/9/14 | 8 | Purohit i | 668.30 cm3 | 4005.83 cm3 | 2874.47 | 41.78 |
| 2 | 21/9/14 to 28/9/14 | 8 | Sheety i | 15835.87 cm3 | 8182.36 cm3 | 7713.21 | 48.52 |
| 3 | 21/9/14 to 28/9/14 | 8 | Gantellu i | 6911.01 cm3 | 4282.09 cm3 | 2628.92 | 38.04 |
| 4 | 21/9/14 to 28/9/14 | 8 | Warwatkar i | 12326.21 cm3 | 6954.64 cm3 | 5371.46 | 43.58 |
| 5 | 21/9/14 to 28/9/14 | 8 | Kulkarni i | 16750.81 cm3 | 12902.52 cm3 | 3848.32 | 22.97 |
| 6 | 21/9/14 to 28/9/14 | 8 | Bhirangi i | 9652.23 cm3 | 7032.06 cm3 | 2620.17 | 27.15 |
| 7 | 21/9/14 to 28/9/14 | 8 | Ladkat i | 9785.14 cm3 | 3831.17 cm3 | 5953.97 | 60.85 |
| 8 | 21/9/14 to 28/9/14 | 8 | Bhide i | 9169.62 cm3 | 4533.77 cm3 | 4635.84 | 50.56 |
| 9 | 21/9/14 to 28/9/14 | 8 | Jagadale i | 6134.35 cm3 | 3846.84 cm3 | 2287.51 | 37.29 |
| 10 | 21/9/14 to 28/9/14 | 8 | Nerlekar i | 6433.59 cm3 | 4533.77 cm3 | 1899.82 | 29.53 |

**Average reduction in volume in Frustrumcone Dustbin = 40.02 %**

**ANALYSIS AND DISCCUSION**

1) Volume available for storage of the dustbin (Cylindrical) : 3367.79 cm3

Average volume of garbage per family per week (Experimental data): 2783 cm3.

If it compressed in Cylindrical dustbin (53%) then volume become 1475 cm3. Volume of the cylindrical is 3367.79 cm3. Therefore it can easily hold garbage of one family per week.

2) Volume of **Frustrumcone** dustbin is 26438.8 cm3

Average volume of garbage per family per week (Experimental data):9993.90 cm3.

If it compressed in **Frustrumcone** dustbin (40.02%) then volume become 6024.96 cm3. Volume of the dustbin is 26438.8 cm3. Therefore it can easily hold garbage of one family per week.

**Testimonials:**

I have shown the dustbin to the following persons-

1. Sweeper of our society.
2. Social worker working in ‘Swach Abhiyan’

There feedback as follows-

1. The sweeper in our society felt the project was very useful and really reduce the pollution, and also reduce the labour of the rag pickers. He added that, if the project was implemented the mixing of garbage will nearly stop.
2. Mr. Sunil Bhondage (The clean city initiative – The Greeny the Great!) appreciated our project and has asked us for 100 such dustbins for his clean city project at Shridi.

**CONCLUSION-**

If we are able to use this dustbin then we can effectively separate dry and wet garbage and send it for recycling and decomposing respectively. This will reduce the pollution. And also prevent health hazards to municipal garbage workers and rag pickers.

**References:**

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2. http://www.online-calculators.co.uk/volumetric/cylindervolume.php
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**Acknowledgement:**

Many people helped and guided me in development and testing of the idea. The project was completed under the guidance of our Ex-Principal Mrs. Nupur Ghosh, Present Principal, Mrs. Renuka Datta, Science project Guide : Mrs. Nisha Hansda and Mr. Bharat Karamarkar .

I am thankful to the team of D-I-Y lab of Vigyan Ashram, Pabal who taught me cutting, drilling, use of grinder for this project.

I am thankful to all these guides who enthusiastically guided me and supported me for the project. I am also thankful to my parents and friends who helped me to collect the garbage from home to home.

Siddharth Kulkarni

**Project By:-**

**Siddharth Kulkarni**

**Dnyanganga College Of Science And Commerce,**

**Pune**

**Email: punesiddharth@gmail.com**