

## Design and manufacture of mechanical drive systems for road sweepers on flat surfaces

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**Abstract:** The sweeper works by utilizing pushing force because it does not use a motor, so it is environmentally and energy friendly. The manufacturing and assembly process is carried out after all machine components are made according to the designed sizes. The working principle of this machine is that the wheel is the driving source using a gear and chain transmission. The driving source for the directional broom is located on the left side of the wheel, using an umbrella gear to change the direction of rotation of the broom to the opposite direction. Meanwhile, for the distribution broom, the driving source is located on the right side of the wheel. By using two gears that touch each other and the difference in the number of teeth, namely three to one, can produce a fast sweeping speed. The function of the directional broom is to direct rubbish that is in the corners of walls or rooms to the middle of the machine. Meanwhile, the function of the distribution broom is to distribute waste to the tub which has been directed by the guide broom towards the middle of the machine. After testing, it turned out that this sweeping machine can optimally pick up all the rubbish on a flat surface along with the dust. The results of the design of this machine have been able to produce very good performance, apart from saving time it also produces fairly clean sweeping results.

**Keywords:** Design; rakers; thrust force; flat plane

### 1. INTRODUCTION

Solid waste is solid material that has negative economic value and is more profitable to throw away than to use [1]. According to the Forestry Department on its website, waste is all material discarded from household activities, trade, industry and agricultural activities. Based on its composition, waste is divided into two, namely Organic Waste, namely waste that rots easily such as food waste, vegetables, dry leaves, and so on. This waste can be further processed into compost. Meanwhile, inorganic waste is waste that does not decompose easily, such as plastic food packaging containers, paper, plastic toys, drink bottles and glasses, cans, wood, and so on. This waste can be used as commercial waste or waste that can be sold to make other products. Some inorganic waste that can be sold is plastic food packaging containers, used drink bottles and glasses, cans, glass, and paper, both newsprint, HVS, and cardboard. Based on its physical composition, waste is divided into organic waste and inorganic waste [2][3].

A street sweeper is a person or machine that cleans roads. This machine was created as a solution to help solve cleanliness problems. Usually the party who has the authority to take care of cleanliness in these places cleans manually using human power, namely with a broom [4][5].

People often throwing away trash has become a culture and tradition for Indonesian society and the surrounding area in general, as if they have done nothing wrong. Even though throwing rubbish is an act of not showing concern for the environment, as reported in a daily news analysis of lack of awareness, Merdeka Square is filled with rubbish.

The design process, which is the general stage of a design technique, is known as NIDA, which stands for Need, Idea, Decision and Action [6][7]. This means that the first stage of a designer is determining and identifying needs. In connection with the tool or product that must be designed. Design begins with determining and defining the problem or required needs. In this case, identifying needs or problems is an important process in the engineering design process. Each component has a



different function and shape. At the end of the design process, these components will be combined into a complete test equipment [8][9][10].

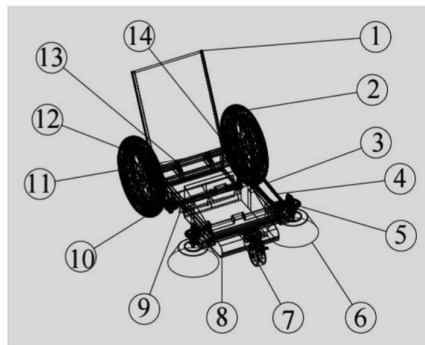
The objectives include, among other things, to make a road sweeper on a flat surface with a mechanical system as the driving tool, to make a mechanical system to drive a guide broom, to make a mechanical system to drive a distribution broom so that it can distribute rubbish to the trash can, and to create a road sweeper in flat plane with a mechanical drive system as efficient as possible.

## 2. METHOD

Designs using Solidworks software can be done easily and cheaply. The results are displayed in 3D and 2D so they are easy to understand. Design is planning in making an object or making a product, system, component or structure. In a broader sense, design is applied art and engineering that is integrated with technology [11][12][13].

The solid capitalization program is based on parametric features, meaning that all objects and relationships between geometrics can be modified again even though the geomatrix is already finished without starting over from scratch. This makes it very easy for us when we are in the process of designing a product or design. To create solid 3D models or import 2D drawings from Autodesk Autocad. After drawing or 3D model [14][15].

### a. Overall design of components



#### Information:

- |                              |              |
|------------------------------|--------------|
| 1. Tool Pusher Handle        | 10. Bearing  |
| 2. Rear wheel                | 11. Frame    |
| 3. Chain                     | 12. Axis     |
| 4. Drive gear                | 13. Bearings |
| 5. Umbrella gear             |              |
| 6. Directional sweep (Front) |              |
| 7. Front wheel               |              |
| 8. Garbage collection        |              |
| 9. Distribution broom (rear) |              |

Figure 1. Concept and sketch of the tool

The following image is the final result of the concept of a road sweeping machine on a flat surface which has been created using the Solidword application. The difference between our machine and existing machines lies in the guide broom. With the machine design that we made using a guide broom. The purpose of having a guide broom is to be able to move rubbish that is in the corner of the room to the middle of the machine so that it can be lifted by the guide broom into the waste storage tub.

### b. Final 3D design results



Figure 2. 3D design

Prepare your computer, this image is a tool for designing well using the Solidwork application. The results of the design of all parts using solidwork, starting from the main frame, tires, waste storage tank, and the drive system for the road sweeper.

### c. Tool making

The mechanical drive of a road sweeper on a flat surface is focused on finding the most efficient form possible. The planned construction that needs to be taken into account is:

1. The first stage is drawing and calculating the frame that looks as efficient as possible
2. The second stage continues with making the frame according to the plan that was made first.
3. The third stage continues with making brooms that distribute waste to the shelter.
4. The fourth stage continues with making a directional broom on the front.
5. Fifth stage: Make a waste storage tank in the middle of the waste.
6. The sixth stage continues with assembling the spoket gear and umbrella gear on the frame to move the guide broom.
7. The seventh stage continues with the integration of all the parts in the main frame of the tool.

Working principle of a street sweeping machine. The working principle of this street sweeping machine is very simple in its operation, by pushing the machine and directing it towards the scattered rubbish. At the front of the machine there is a directional broom whose function is to direct waste into the machine to be stored in the reservoir. Inside the machine there are two cylindrical brooms that rotate in opposite directions which are driven by wheels and connected to gears to create opposite rotation. When the machine is pushed, the shaft connected to the cylindrical broom will rotate counterclockwise because it gets rotational power from the gear wheel which is the same as the wheel to sweep and lift the rubbish that will be collected into the rubbish bin.

### 3. RESULTS AND DISCUSSION

Making the wheels, my rear wheels use wheels measuring 17 in circumference which are connected to the machine body using an iron axle, while the wheels on the front of my machine use a single wheel which can rotate 360 degrees.



Figure 3. Wheel manufacturing

Creating a steering broom drive system, with two directional brooms located at the front of the machine which can direct the waste to the center in the corners of the room or the corners of the walls. By rotating the two brooms in opposite directions, you can direct the waste to the middle of the machine.



Figure 4. Final result

Figure 4 has the following specifications;

Tool specifications;

Frame size

- a. Length (L): 100cm

- b. Width (L): Rear 60 cm / Front 80 cm
- The size of the tool handle
- a. Length (L): 80 cm
  - b. Width (L): 60 cm
- The size of the waste container
- a. Length (L): 80 cm
  - b. Width (L): 60 cm

### Tool testing and test results



Figure 5. Test results

After testing, it turns out that this sweeping machine can optimally pick up all rubbish on a flat surface and its dust, but not large stones.

### 3 CONCLUSION

The conclusions that can be drawn from the design of a road sweeper with a mechanical broom drive system were successful in designing a road sweeper on a flat plane whose shape was as simple as possible, successful in designing each part of the road sweeper on a flat plane, successful in designing the entire road sweeper on a flat plane. in 3D, succeeded in making a road sweeping machine on a flat plane with an angle iron frame, a zinc reservoir, a guide broom, a distribution broom, and a drive system for a road sweeping machine on a flat plane. Make a directional broom on the right and left front sides so that the waste collects in the middle of the machine. Make a distribution broom in the middle of the tool that rotates towards the back so that the waste that has been directed by the guide broom can be lifted and placed in the waste bin. And make a road sweeping machine on a flat surface in the most efficient form possible so that it can be used easily.

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