

# Design of Solar Powered Portable Automatic Paper Bag Manufacturing Machine

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**Abstract** –In the field of manufacturing it is high time to exploit the latest knowledge of renewable energy. This research paper focuses on the study and design of solar powered semi automated paper bag making machine. The design of the machine is such that it requires solar energy and not the conventional power supply, thereby making it functional in areas with scarcity of power. The machine is convenient to handle, and the most vital aspect is that it is cost-effective so that it can own by mass base of rural population. This is important in a country like India as it makes it trouble-free for people to produce paper bags on a small scale and earn a livelihood

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## I- INTRODUCTION

With the recent prohibition on the use of polythene bags in the country, there has been a surge in demand of paper bag manufacturers. However, for better implementation, the rule needs to be obeyed at the grass root level by shopkeepers, vendors etc. The major obstacle to overcome in paper bag manufacturing is the high initial investment cost of the machine. In this paper, we have proposed ways in which this cost can be brought down and how to implement these ways pragmatically to make a feasible small-scale model of the machine. This will make the machine financially accessible to the economically weak working section of the society, enabling them to buy the machine at significantly low rates and producing paper bags to sell on a small scale.

Although India is not a major consumer of plastics on a global level, 24 pounds of plastic are consumed per capita. It has poor waste management as once these bags are thrown away; they end up in the landfill or get burned. The former solution only leads to the land.

Holding onto the waste indefinitely because the litter is not biodegradable and the latter one releases fumes in the atmosphere which increase the level of VOCs in the air. It poses threat to wildlife, especially when plastic is dumped into oceans.

We require small bags for grocery, vegetables etc on a day-to-day basis. Plastic shopping bags have a huge impact on the environment for something so seemingly harmless. Therefore, the need for a viable alternative to plastic bags arises. This is when we switched to paper bags. The machine designed uses solar energy which is converted from the rays of the sun by exciting electrons in the silicon cells using photons (also called as packets of energy) of light from the sun. One of the major advantages of solar energy generation is that it produces no waste or emissions whatsoever. Unlike traditional energy sources like fossil fuels, they create clean, renewable energy from a source of fuel that requires no locating, excavation, transportation or combustion.

Fossil fuel deposits are limited and scattered unevenly all over different locations, whereas solar energy is available nearly everywhere. Although the initial investment of a solar power circuit is considerable, after a while you will hit a point where the circuit has paid for itself and end up saving thereafter.

To sum up everything that has been stated, the design of the portable paper bag manufacturing machine aids in reaching rural areas, makes the environment cleaner, help make small scale production and selling of paper bags more convenient than ever and all of which while keeping in mind the economic feasibility of the model.

## II- OBJECTIVE

The machine is to be made for mass base people of all economic group for their businesses. For example, even small businesses which operate from home should be able to come up with the money for this equipment.

This unconventional power source makes people able to manufacture paper bags according to the need and also use raw material which is regularly voluntarily available.

The objectives of machine are:

- To make manufacturing of paper bags easy.
- To keep the environment clean and safe.
- To make it economical, flexible and compact.
- To vary bag length through human machine interface.
- To solve the customer's requirements, we make use of unusual machinery .

## III - LITERATURE REVIEW

Margaret E. Knight (February 14, 1838 – October 12, 1914) [1], an American inventor, while living in Springfield, Massachusetts, Knight invented a machine that folded and glued paper to form the flat bottom brown paper bags that are used today. This invention was the reason that flat bottom bags were thereafter used widely all over the world. The machine was manual and required two to three people to operate.

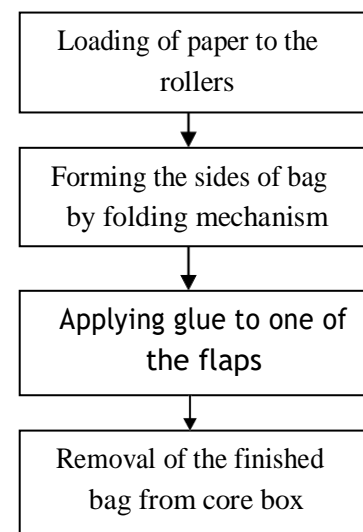
Chas Stilwell patented a paper bag machine. Stilwell put into operation the first machine to produce paper bags. These bags had flat bottoms for standing up straight by themselves and pleated sides that made them easy to fold and stack. Hence, it reduced the space for storage.

Patent office issued a patent to, William Purvis [2] for a paper-bag machine which had the combination of two suction-formers having surfaces with holes, between which the ends of the paper tube are fed, and provided with two independent grooves arranged at different positions of the length of the formers and out of linewith each other.. This mechanism was especially used for square bottom bags.

This study is based on these previous inventions and new technology has been introduced so that reduced human effort is required. Radically the cost is reduced by using Surplus equipments and other accessories.

## IV - METHODOLOGY

A used newspaper is fed to the rollers. This enables the paper to go around the core box and form the base shape of the bag. A sliding mechanism (using rack and pinion) which carries all the flaps required for manufacturing is activated. This folds all the excess paper and forms the remaining sides of the paper bag. Along with the folding, it also applies glue to one of the paper flaps so that they are properly stuck. Once this operation is completed, the pinion is made to return to the original position. The finished bag is removed from the core box manually. This bag can now be used for various applications.



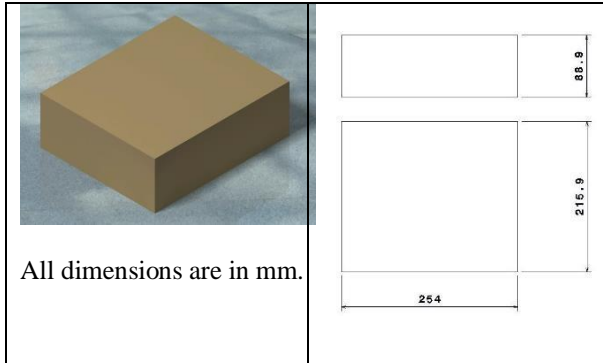
## V - DESIGN

The machine is designed in such a fashion that, in order to get complete work done by utilizing minimum number of working mechanisms. A framework with fix core box is designed which contains a rack and pinion arrangement. The paper is fixed on the core box by use of rollers and 5V motor mechanism. This frame also contains a bigger box which can be driven by rack and pinion under power provided by 12V motor. This bigger box is hollow and contains three different flaps and a gluing mechanism fixed to the second flap. The bigger box moves from A point to B point of framework providing the folding and gluing mechanism to paper fixed on core box. The Paper bag is then extracted from the machine by rolling the rollers in opposite direction.

### Components:-

**Core box** is used to give support to the paper for folding it into the paper bag for required shape and size. It is

rectangular in shape and the core box basically holds the paper and various mechanisms are applied to make Paper Bag. It is made of wood and is hollow. The size is 10" x 8.5" x 3.5".



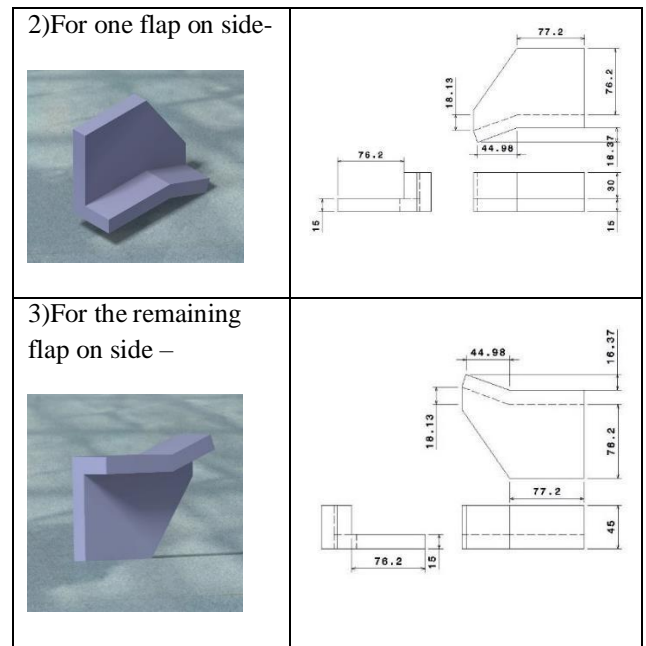
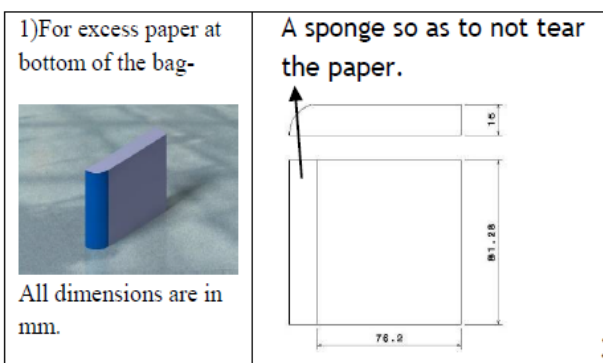
**Rollers** are mounted on the frame which feed the paper to the core box. The paper moves from the bottom of the core box to the upper side of box. The roller used is cheap as it was picked up from a broken Xerox machine. Hence, there are already attachments available for connection to a motor.



A roller from a Xerox machine [3]

**Motors** are used for moving the rollers in clockwise direction for feeding the paper. Motors are also used to drive the rack and pinion which is used in later part of the mechanism. Two motors of power 12V and 5V are used.

**Flaps** are attached to the frame and perform folding mechanism. Three flaps are used, one for folding the paper in horizontal direction and two for folding the paper from lower side and upper side. These are mounted on both sides of the frame. Flaps in order –



**Glue** is used to stick the paper and the glue is also mounted on both sides of the frame. Glue allows you to apply it to the thin layers which won't crinkle the paper. Flour Glue is used as it is Safe, clean and quick adhesive. Glue application would immediately take place after folding would be completed.

**Rack and Pinion** is used for moving mechanism forward and backward direction so that the mechanisms attached to the frame can perform their work. A Rack and Pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. Rack length is 42 inches.

**Power Supply** is used for running the Paper Bag Machine and **Step-Down Transformer** is used which converted ac 230 V to 12 V, after this you will get a 12V pulsating AC voltage which help in meeting the working of the Paper Bag Machine. **Rectifiers** [4] are used to rectifying the signal. Rectifying means convert the ac signal to dc as possible. Bridge rectifier consists of four diodes which are connected in the form a bridge. During positive half cycle, diodes D2 and D4 will conduct and during negative half cycle diodes D1 and D3 will conduct. Thus, AC is converted into DC; here they obtained is not a pure DC as it consists of pulses. After rectifying the signal, it consists of ripple noise in dc signal that is not perfectly suitable for operate the circuit.

**Capacitor** is used to filter the signal. In the circuit, capacitor stores energy while the input increases from zero to a peak value and, while the supply voltage

decreases from peak value to zero, capacitor starts discharging. This charging and discharging of the capacitor will make the pulsating DC into pure DC.

**Voltage Regulator** is used to step down to 5V DC voltage, LM7805 IC for 5V and IC-7812 for 12V.

**Solar panel** absorbs sunlight as a source of energy to generate electricity. 5V, 1.6A Solar panel with dual output of 1A and 2.1A is used.



Solar Panel to be used in the machine [5]

## VI - FUTURE SCOPE

As people are becoming more aware of the dangers of using plastic, they have started to avoid using plastic bags. Even governments are starting to ban them. Hence, in future, paper bag manufacturing will be on the rise. And, hopefully, we will see a boom in this business.

There can be various modifications made in this machine which will increase the variety of the paper bags. A different core box size might lead to variety in sizes. Different types of papers might also be used. All these changes can be achieved with very few changes in the machine.

Advancement in solar technology will certainly lead the way in terms of providing power to the machine. At this stage, solar panels are still a bit costly. Once they are affordable, cost of power required will be drastically reduced.

This kind of machine may also be used in a community of shopkeepers, for example, in markets where there are many vendors close together. In such cases, they can use a single machine as a community, which will make paper bags even more affordable.

## VII - CONCLUSION

We have been able to design and develop a semi-automated solar powered, low cost paper bag making machine for different objectives. Unlike the current technology in this field which is expensive and

commercial, our work is not only of good feasibility, high efficiency, but also with high robustness.

Objectives Accomplished:

1. With this study, our goal was to automate paper bag machine in order to reduce the man power and to increase the efficiency.
2. This system contains the parts which are retrieve from redundant machines.
3. All the current machines available are very expensive and also not suitable for domestic applications in terms of sizes. Simple and compact mechanisms used in this machine make this a viable option for smaller shops.
4. The cost of this machine is appreciably lesser than currently existing machines.
5. This machine is also environment responsive with respect to energy sources.

## REFERENCES

- [1] Margaret E. Knight, "Paper Bag Making Machine", US Patent No.116842.
- [2] William R. Purvis, "Paper Bag Making Machine", US Patent No.434461.
- [3] <https://www.indiamart.com/proddetail/xerox-machine-magnet-roller-ptfe-coating-service-12467133873.html>
- [4] [https://www.electronics-tutorials.ws/diode/diode\\_6.html](https://www.electronics-tutorials.ws/diode/diode_6.html)
- [5] <https://robu.in/product/5v-1-6a-8w-solar-mobile-charger-with-1a-2-1a-dual-usb-output/>