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Design and Fabrication of PET Filament Making Machine

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***Abstract:** 3D printing is a form of additive manufacturing technology where a 3D object is created by laying down successive layers of material. It is mechanized method whereby 3D objects are quickly made on a reasonably sized machine connected to a computer containing blueprints for the object. As 3D printing is growing fast and giving a boost to product development, the factories doing 3D printing need to continuously meet the printing requirements and maintain an adequate amount of inventory of the filament. As the manufactures have to buy these filaments from various vendors, the cost of 3D printing increases. To overcome the problem faced by the manufacturers, small workshop owners, the need of 3D filament making machine arises. This project focuses on designing and fabricating a portable fused deposition 3D printer filament making machine with cheap and easily available components to draw 2 mm diameter ABS filament.*
***Keywords:** 3D printing, filament, recycling, PET bottles, machine*

I. INTRODUCTION

Nowadays one of the largest downside in 3D printing is that the comparatively high price of filament, i.e the 3D printer (thermo-) plastic, the "consumable" for your 3D printer. Costs for 3D printers are endlessly decreasing but the cost of filament is same. Filament handiness is way higher than past two or three years, as are color selections. Even the materials for 3D printing have become a lot of varied and pronto obtainable. Some crafty makers/inventors are developing the simplest way for personal people to provide them 3D printer plastic filament, at solely a fraction of its retail worth. They have developed a alleged "filament extruder" for home use, i.e a machine capable of spewing out plastic filament that you'll later use in your 3D printer. The exposure below shows you ways such Associate in Nursing extruder seems like.

Let's have a fast look into these machine's operating principles before analyzing the filament production method furthermore as material costs. 3D printing could be a means of quick prototyping, creating totally usable models and whole projects. Nowadays we are using 3D printed parts in each project, components are tiny, however we need them to be sturdy, for instance, gears, clutches, motor mountings. Scientists are developing techniques to enhance mechanical properties of prints. The chances that 3D printing provides us are irreplaceable, very low price, speedy stage of computer aided design conversion into a true object, 3D printing permits us to form parts that are inaccessible by alternative methods. Throughout the prototyping, a lot of filament and components are discarded as waste as unsuccessful prints, poorly designed models or poor print optimization. Making a totally satisfying print brings a lot of unused material that goes into the bin. Living in an era where loads of garbage is made, as well as giant quantities of PET bottles so we are connecting this waste procedure with our passion and work. Just like other researchers, we aim to decrease our environmental impact and trying to reuse materials for 3D printing. This article is about simple mechanical device that enables us to convert unused PET bottles into the 3D printer filament. PET filament is extremely sturdy, temperature resistant and easy for printing.

II. LITERATURE REVIEW

Alvaro Goyanes et al (2014), their project is to build an extrusion machine that creates 3D printer filament from water bottles, these water bottles square measure typically polythene terephthalate (PET) materials that square measure taken as intake for creating filament. Mark D Grooms (2016), their project is to develop a 3d printer filament extruder at low value with the assistance of the materials and elements that they got the scraps and that they mentioned to use simple materials to complete the whole product. Antonim durna (2014), this text deals with the modification of the nozzle and its entire assembly with a hot finish, in order that it had been not necessary to use a Teflon insertion and to succeed in the most temperature of the nozzle. Kreiger et al (2014), here they mentioned the various sorts of materials that may be used for 3D printer applications and their properties of the materials supported melting temperature and set temperature.

Meera Mohan et al (2017), during this project they need researched and studied concerning completely different the various sorts of temperatures sensors that may be utilized in different applications to live the specified temperatures. Seyeon Hwang et al (2015), during this project he had studied and analyzed concerning completely different the various sorts of materials that may be utilized in the filament extrusion method and conjointly their different mechanical properties that must be contemplate whereas choosing a filament.

III. CONSTRUCTION

A. Construction of the Machine

The machine is made of simple mechanical parts. Every part is mounted to the machine by screws in properly designed places. Dimensions and designed model of the machine are shown in the picture below [Fig. 1].

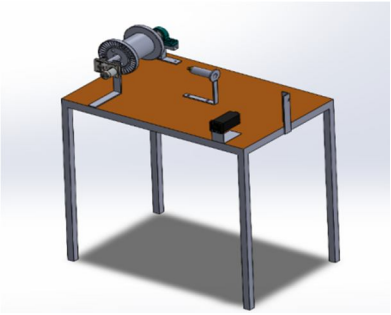


Figure 1. The project of the machine.

The model was designed in SolidWorks modelling software.

B. Construction of the Control Panel

The operator panel consists of universal temperature controller (UTC) powered by 230v, that is controlling the temperature of the head [Fig. 2]. Temperature data is provided by thermocouple K placed in the head. The heater of power 40W is connected to this device and powered by 12V. This allows reaching temperature up to 250°C. On the left side, we can see PWM controller with built-in on/off switch, that is responsible for controlling spool rotation speed.

Figure 2. Universal temperature controller.

C. Design of the Extruder

The extruder [Fig.3] is made of regular cast iron, specially drilled nozzle allows extrusion of filaments with a diameter of 1.75mm. A plastic string passes through the extruder, which is plasticized and then formed by a nozzle into a filament.

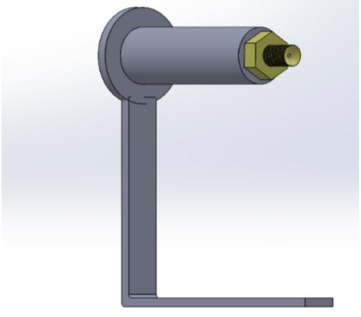


Figure 3. Extruder

D. The Filament Creation Process and Machine Operation

At the beginning, there is PET bottle cutter which cuts the bottle into a narrow strip. A narrowed plastic strip should be inserted through the cold nozzle power supply, which will greatly facilitate the initial extrusion of the filament through the nozzle, the next step is connecting the power supply. After that, the switch on the side of the case should be switched on. Activated universal temperature controller is now extruder to set temperature 250°C, and this temperature was chosen experimentally. When the extruder reaches set temperature, the plastic strip should be drawn manually until you can attach it to the spool. Now by switching on and regulating rotation of spool, the molten plastic is forced through the hothead, then cooled and hardened, and then wound on a spool.

IV. PROCEDURE

First we have to clean the bottle by washing it and drying it completely.

1) Then we have cut the base of bottle horizontally with the cutter.
2) We have to give a cut of 10mm to the bottle at bottom in a specific angle range between 20° to 40°.
3) Insert the pointed portion into cutter slot of 6mm or 8mm depending upon the thickness of the bottle respectively. Pull the pointed portion from other side of the cutter with plyer.
4) With the help of plyer insert the strip into the extruder and push the strip inside till it the comes out from the exit of nozzle.
5) Let the filament cool and then slowly pull the filament with the plyer till it reaches the winding spool.
6) Tie the filament to winding spool with help of wire.
7) Now the filament will start winding automatically.

V. CONCLUSION

In this paper, we have introduced the design and model of a filament machine and proposed an alternative way to create ecological filament. We have tested the machine and filament comparing with generally available filaments in simple tests. It was a success to receive a filament that can be used in a regular 3D printer from ordinary plastic bottles.

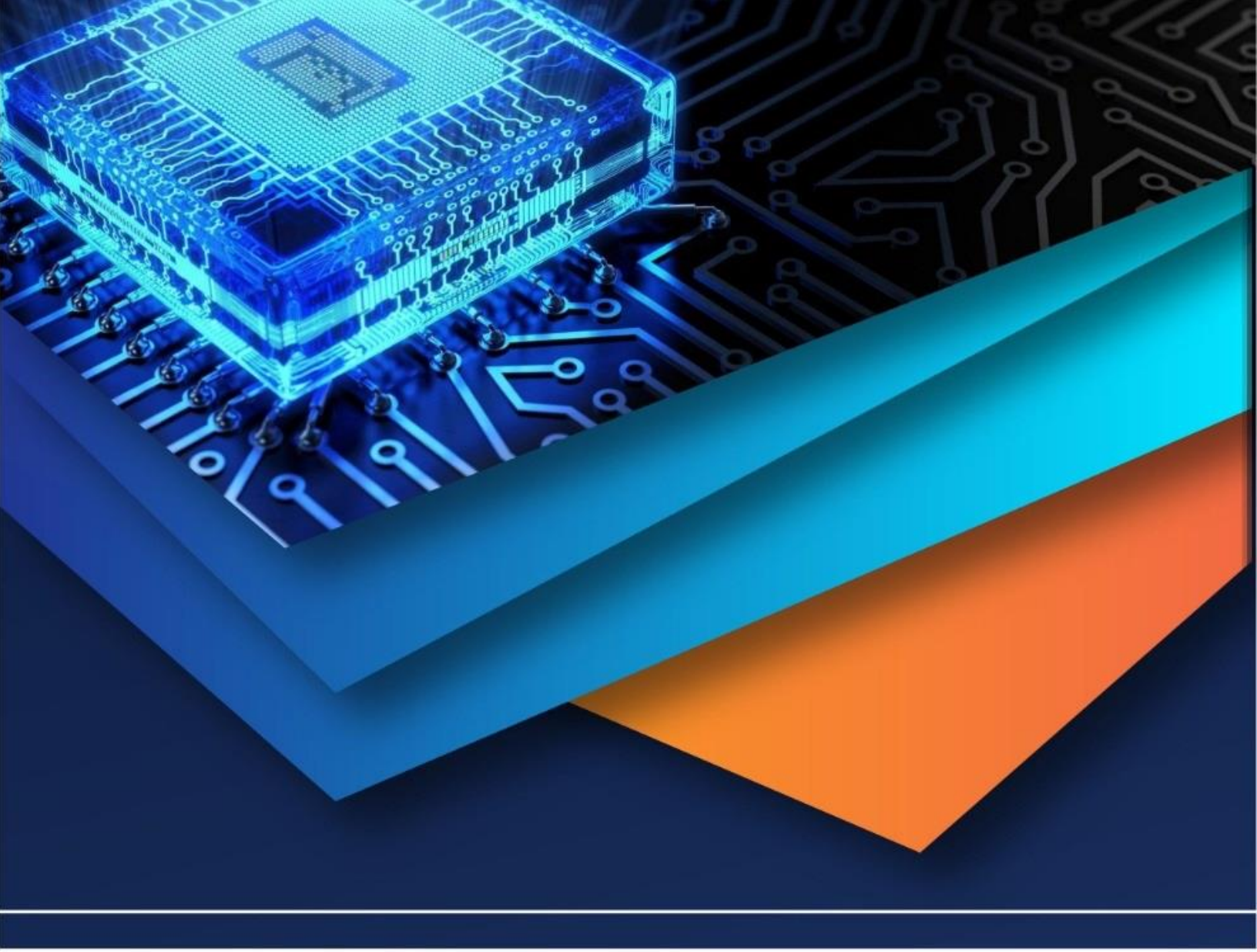
The researches shown in the article allowed the analysis of the created material that has a lot of potential, even in the promotion of waste recycling, and in the future, creating durable elements.

Creating and using BPET filament with printing parts on a 3D printer requires deeper and longer analysis. It is a prototype, and the machine has many drawbacks that need to be corrected.

There are several solution of similar machine available. Presented method in the article is the least popular. The most popular way to create filament from plastic bottles or plastic waste is creating granules and then using those for processing, this is more complicated process and the machine is much bigger, not that compact size like machine presented in this article. Compared with another constructions machine showed in this article is made in 90% from 3D printed parts which affects the low price of the device.

REFERENCES

[1] B. N. Turner, R. Strong, and S. A. Gold, “A review of melt extrusion additive manufacturing processes: I. Process design and modeling,” Rapid Prototyping Journal, vol. 20, no. 3, pp. 192–204, Apr. 2014.
[2] R. Elhajjar and T. Gill, Studies into Additive Manufacturing for InSpace Manufacturing, Warrendale, PA: SAE International, 2016.
[3] K. Dzierzeket al., “Design and static tests of an all-terrain suspension system for electric wheelchair,” in Proc. 2018 International Conference BIOMDLORE, Bialystok, 2018, pp. 1–5.
[4] M. Rećko, J. Tołstoj-Sienkiewicz, and P. Turycz, “Versatile soil sampling system capable of collecting, transporting, storing and preliminary onboard analysis for mars rover analogue,” Solid State Phenomena, vol. 260, pp. 59–65, July 2017.
[5] P. Tomaszuk, A. Lukowska, M. Recko, K. Dzierzek, and P. Straszynski, “Active wheel speed control to avoid lifting the swingarms in rocker-bogie suspension,” in Proc. 2019 International Young Engineers Forum (YEF-ECE), Costa da Caparica, Portugal, 2019, pp. 36–39.
[6] P. Tomaszuk, A. Lukowska, M. Rećko, and K. Dzierzek, “Integrated drive system of robotic arm joint used in a mobile robot,” in Proc. 2018 23rd International Conference on Methods & Models in Automation & Robotics (MMAR), Miedzyzdroje, 2018, pp. 509–514.
[7] A. Lukowska, P. Tomaszuk, K. Dzierzek, and L. Magnuszewski, “Soil sampling mobile platform for Agriculture 4.0,” in Proc. 2019 20th International Carpathian Control Conference (ICCC), Krakow-Wieliczka, Poland, 2019, pp. 1–4.
[8] A. Prusinowski and R. Kaczyński, “Simulation of processes occurring in the extrusion head used in additive manufacturing technology,” Acta Mechanica et Automatica, vol. 11, no. 4, pp. 317–321, Dec. 2017



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