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1ST INTERNATIONAL CONGRESS ON ADDITIVE MANUFACTURING BOOK OF ABSTRACTS

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Construction of an optimized 3D Printer, programmed by Arduino and designed in SolidWorks software

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ABSTRACT

The 3D printer is a prototyping machine capable of producing three-dimensional objects, distributed in 3D software, which are built after layer through an additive process. This project aims to develop a low-cost open-source 3D Printer controlled by Arduino. It also aims to deepen the topic of rapid prototyping and provide the community, internal and external, of the Polytechnic Institute of Bragança (IPB), with a base for developing these printers so as to benefit from the study of new technologies and their replication. The most common and economical model, of a 3D printer, uses the technique of modeling by fusion and deposition (FDM - Fused Deposition Modeling), which is the base technology of our project. At the beginning of the project, we were proposed to design a 3D printer. In this there was the electronic/programming part already validated, with the need to build the mechanical part of it. Thus, we proposed to continue the base of the existing project, having carried out all the mechanical modeling of the printer and validating the design of the various parts that had to be raised in order to meet the various requirements this one demanded. There was also a survey of suppliers of various parts on the market from which an extensive list of references, suppliers, values, quantities, and forms of acquisition was drawn up. In order to make the final physical assembly possible, they were machined as aluminum parts, obtaining structural strength and reliability of the set. Aluminum parts were marked in order to able to use the "leftovers" existing in the mechanical workshop and thus manage to reduce and consolidate the final cost of the project.[3]

INTRODUCTION

The present project arose from the need to create a large 3D printer for the Fablab laboratory of the Instituto Politécnico de Bragança. At the beginning of this one, we were proposed to continue a project for a 3D printer. In this one there was an electronic/programming part already validated and there was a need to build the mechanical part of it. So we proposed the basis of the current project and continued until today a mechanical modeling of the creator as valid and the design of the various pieces that had to be created as a behavioral project end as typical characteristics of this project. Also that of the suppliers of various parts on the market from which a list of references, suppliers, values, various forms of acquisition was prepared. The one presented here is based on the analysis, modeling, creation and assembly of a D-printer using FDM technology that guarantees a greater robustness of the components seen to guarantee a greater extension and reliability mostly used [3].

RESULTS

In this project we were able to understand the entire process involved in this technology, from the materials used, the different types of printing filaments and associated technical

areas. This complementing our intense research work and looking for new solutions for the practical and technical realization of this 3D printer, we prepare an inventory of parts, functional design in solidworks with the actual measurements used, through the projection and completion of the project. We faced several difficulties such as the collision of pieces in solidworks, which we resolved by adapting and testing several times until reaching the final result presented here. Of all the pieces created for this purpose, we highlight the printing platform, which will support the heating plate, which is where the 3D pieces will be built [4]. Three attempts were made in order to reduce the weight of the part without compromising the normal functioning of the structural set, as described in the chapter "design in solidworks". For this purpose, the stress and strain installed were studied by applying a distributed load of 1kg along the platform in order to represent the weight attributed by the heated table, adding to the component to be built. This was calculated knowing that the weight of the heated table of dimensions (300x200mm) is approximately 300g and that the structure built in PLA filament in the maximum printing dimensions of the printer (200x180x450mm) is approximately 600g, leaving a safety margin of 100g. This entire project was a challenge at different levels, both in terms of geometric design and modelling, and in the selection of the best option for the components, in terms of quality/price. To this end, an inventory was drawn up and the material needed to build the 3D printer was ordered. Tables of suppliers, parts and corresponding acquisition value were also prepared. As described throughout this work, the final purchase and assembly value of this printer was €550.55 + taxes. Aluminum cutting and drilling were carried out in the mechanical workshop of ESTIG's mechanical technology laboratory. 62 The final assembly of the components was carried out in ESTIG's FABLAB laboratory and a level was used to level the aluminum rails, this operation being carried out on top of the CNC, since its table is perfectly leveled to the ground, which facilitates the our assembly accuracy.

CONCLUSIONS

With this project, one of the conclusions we obtained after gathering all the components of this printer, is that its monetary cost, although higher compared to others in the market of the same category, remains below when faced with: quality of components, rigidity of the structure and adaptability of the existing components as well as superior print dimensions. The robustness of the components was achieved by oversizing to ensure greater longevity and reliability due to the aluminum mostly used. In this way, the guidelines of all the objectives defined by this work were fulfilled, which defined, among others, some existing materials to be included and the desired size of printing capacity.

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