DESIGN AND DEVELOPMENT
OF MULTI-NOZZLE EXTRUSION SYSTEM FOR 3D PRINTER

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Introduction. The main purpose of the project is the design, development and application of an extruder with five nozzles for fused filament fabrication (FFF) type 3D printers. The extruder should be able to use five different colors or materials, thus expanding the capability limits of currently existing 3D printers.

Materials and methods. The fundamental design will be based on currently existing direct and Bowden extruders [1-3]. Firstly, the optimizations will be made on theunique extrusion mechanism which includes two driving motors, one of which will be exploited for the change of filaments by rotation; the other motor will be used for driving the filament into the hot end of the extruder. Secondly, the extrusion head will contain five nozzles which would allow the use of different materials and colors. Each nozzle will be individually temperature controllable. Thirdly, the cold end of the extruder will be located separately on the frame of 3D printer, so the hot end will be Bowden fed. This development would lead to the decrease of weight of moving part of the extruder which is important for the increase of print speed and printing volume. The conceptual design will be prepared on SolidWorks 3D CAD design software. The controlling part will be prepared on a programming tool based on C++ language. The testing will be performed on a hand built 3D printer. Figure 1 shows the extruder and filament feeding method of the new designed 3D printer.

Results and discussion. The expected result is the successful implementation of the multi-nozzle extruder in 3D printers. In other words, the project's positive outcome is obtaining a multicolored and multi-material 3D object with a relatively increased printing speed and with a low-cost extrusion head.

Fig.1. Five-nozzle based 3D printer

Conclusions. As the project is on its design stage, the conclusions will be made based on the results. The positive outcome of the project should generate a big interest among 3D printer manufacturers and designers due to expansion of 3D printer capabilities.Further work should be done on the improvement of a printed object's quality which includes the surface smoothness, tensile strength, support design.

References.

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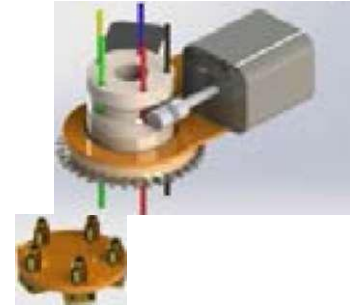   [Accessed 2 November 2014]