UNIVERSITI TEKNOLOGI MARA

DESIGN, ANALYSIS AND FABRICATION OF FILAMENT EXTRUDER

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ABSTRACT

Additive manufacturing or popularly known as 3D printing is the latest 3D printing technologies that have been widely used by various big sectors such as manufacturing, healthcare, education, aerospace, electronics and small-scale industries including individual or home users for their finished product, sample or as conceptual design. 3D printing is a process in which products are made by using material such as plastic or metal by layering on one after the other, creating a three-dimensional object. This printing process will eventually create a waste material that is proven to contribute to our environmental pollution. The solution needed is to recycle the waste materials. However, currently, the recycling machine used for extruding this 3D printer filament is normally very expensive and large unsuitable for all places specifically for individuals, laboratory, university or small medium enterprise/manufacturer. Therefore, this project proposal's main objective is to design, analyze and fabricate a low-cost 3D printer filament extruder as proof of concept. The methodology used is to study existing models and redesign with computer-aided design software prior mechanical & electrical fabrication and commissioning. This project is expected to successfully build the low-cost filament extruder to recycle the 3D printing waste materials which may be helpful to our sustainable environment, minimize the filament consumption cost and affordable to individual or home users.

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INTRODUCTION

1.1 Background of Study

3D printing is one of the latest printing technologies that have been widely used by various sectors like manufacturing, healthcare, education, aerospace, electronics for finished product, sample or as conceptual [1].

3D printing is proven to be cost effective in terms of production process, custom-made and additional production value to industrial groups such as aerospace and medical companies [2]. By adding materials one after the other, digital fabrication technology—also known as 3D printing or additive manufacturing makes physical products from geometric models [3].

Today there are many methods of added ingredient production technologies in the market. The most common techniques are selective laser melting (SLM), selective laser sintering (SLS), stereolithography (SLA) and fused deposition model (FDM). Nevertheless, the utmost widely used form of additive manufacturing technology is the FDM printer. The FDM process includes the press out of a resin plastic filament into a hot nozzle and then covered surface by surface onto a print platform to design the required 3D object. Acrylonitrile butadiene styrene (ABS) and polylactic acid (PLA) are the most thermoplastic materials usually used. Other than that, many filaments with different types of properties have also been increasing like nanocomposites, ceramics and biopolymers [4].

Typically, the 3D printing waste materials are improperly disposed of by the operators. This irresponsible activity will eventually contribute to environmental pollution which is one of the main causes of the plastic waste issue in 3D printing. There is a lot of plastic waste because of 3D printing procedures including misprints brought on by defective designs or improper material usage, excessive prototype printing, filament leftover from prior print jobs, and design-relevant supporting structures [5].

The world productivity of plastic-based products has increased remarkably in recent years [6]. As reported by PEMRG (Plastics Europe Market Research Group), global plastic production in 2019 totals 359 million tons, of which 17% is in Europe and 51%