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TOPIC PROPOSAL FORM
BACHELOR OF SCIENCE IN MECHATRONICS ENGINEERING

Project Title:	Design and Development of a PLA Filament Extruder System for Excess and Reject 3d Print Materials	
Group Number:	MEXE 24-011	
Project Adviser:		
Co-Adviser		Name of Co-Adviser
SDGs Addressed:	SDG 9 - Industry, Innovation and Infrastructure	
Date Submitted:	October 2, 2024	
Project Duration:	6 months (Starting December 2024 to May 2025)	
Rationale:	The rapid growth of 3D printing technology has led to an increase in the volume of excess and reject materials generated during the printing process, particularly in the form of failed prints, supports, and leftover filament. PLA or polylactic acid is one of the most used 3d printing filaments and is known for biodegradability and ease of use. On the other hand, the environmental impact remains a concern due to excess waste and reject models due to to failed print and some are unused filaments [1]According to a study by Hachimi et. al. (2021), a big challenge into additive manufacturing or 3d printings is the availability of the material. Their design of a filament extruder from recycled thermoplastic materials has great results in terms of characteristics of the filament that is produced. They have successfully made a filament that is close to a real filament and almost have the same properties with minimal difference. They have concluded that the mechanical property of the filament produced is within their satisfactory range. [2] Based on the research made by Nassar et. al. (2019), high quality filament requires the proper setting of temperature and extrusion. If either of the two is not properly in line, the quality of the filament may differ and can result in the plastic not fully melting, bubbles forming etc… The temperature will differ as the composition of the filament may change. Their extruder were able to produce commercial quality filament that can be used in 3d printing. Ultimately, this project could have significant implications for industries and individuals using 3D printing technology by promoting a sustainable and cost-effective approach to material usage, while also reducing the environmental impact of plastic waste. Key words: 3d printing, filament, extruder	

	References: [1] Taoufik Hachimi, Nassima Naboulsi, Fatima Majid, Rajae Rhanim, Ibrahim Mrani, Hassan Rhahim, "Design and Manufacturing of a 3d Printer Filament Extruder", 2021 ScienceDirect [Online], Available: https://www.sciencedirect.com/science/article/pii/S2452321621001967 Design and Manufacturing of a 3D printer filaments extruder - ScienceDirect [2] Nassar, Mona A., El Farahati, Mohammed A., Ibrahim, Saber, Hassan, Youssef R., "Design of 3d Filamnet Extrtuder For Fused Deposition Modelling(FDM) Additive Manufacturing", 2019 ResearhGate [Online], Available :https://www.researchgate.net/publication/369992070_Design_of_3D_filament_extruder_for_Fused_Deposition_Modeling_FDM_additive_manufacturing Design of 3D filament extruder for Fused Deposition Modeling (FDM) additive manufacturing
Pre-Requisite(s):	ECE 415 - Microprocessor and Microcontroller Systems and Design MexE 408 – CAD/CAM and CNC ENGG 412 – Materials Science and Engineering ICE 405 - Sensors Engineering
Research Questions:	1. What will be the key difference of aftermarket filament compared to the reused filament? 2. How can the design of a PLA melting system optimize the quality of recycled filament for subsequent 3D printing use? 3. What are the cost implications of implementing a PLA melting system for personal and small-scale 3D printing operations? 4. What challenges exist in maintaining printing quality of the PLA when its melted and re-extruded for 3d printing?
Research Objectives:	1. To determine the design requirements for the PLA melting system. 2. To design the PLA filament extruder system compliant to the design requirement. 3. To develop and assemble the prototype of PLA filament extruder system. 4. To test the filament produced by the system in 3d printing and compare it to the aftermarket filament.
Resources Needed:	Heating element, Extruder, Frame, Electronic Component, Sensor Technology, 3d Modelling Software,
Are the existing facilities at the College sufficient to carry out this project work? (Yes)	
Does the student need special training to use any College lab equipment? (Yes/No) If yes, how will this be provided?	

Proposed Budget (PHP): 20,000 to 30,000

Item	Estimated Cost Range (PHP)	Example Components

Frame Material	3,000 - 5,000	Aluminum Frame, plywood, Stainless Steel
Electric Motors	1,500 - 3,000	Nema 17, 23, 34 Stepper Motor
Heating Element	100 - 300	Heating Aluminum Blockh
Cooling Block	250 - 750	Heat Sinks
Nozzle	150 - 500	Brass Nozzle
Fabricated Metal Components	2,500 - 5,000	Auger,
Power Supply	500 - 1,000	Switching Power Supply e.g.(5v, 12v, 24v)
Sensors	500 - 1,000	Temperature sensor (e.g., LM35) & laser sensor
Cooling Fans	100 - 500	DC Cooling Fan
Microcontroller	1,000 - 2,000	Arduino Mega or similar
Miscellaneous	1,000	Wires, connectors, soldering supplies
Total	**10,500 - 20,000**	

Is there any external financial assistance to support this project? (Yes/ No)

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Patrick James G. Verroya -

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