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### **RESEARCH ARTICLE**

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## REVOLUTIONIZING MASS PRODUCTION: A DUAL POWER PORTABLE PHOTOGRAPHIC SILKSCREEN PATTERN EQUIPMENT

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#### **ARTICLE INFO** ABSTRACT Article History This research endeavors to introduce and evaluate the efficacy of a newly designed Portable Received: January 04, 2024 Photographic Silkscreen Pattern Equipment integrated with a dual power source. Engaging a cohort of 88 participants across various departments, alongside input from eight experts in Revised: January 20, 2025 Drafting Technology at Zamboanga City State Polytechnic College, a survey questionnaire Accepted: May 15, 2025 Published: May 31, 2025 facilitated data collection via a convenience sampling approach. The study unequivocally establishes the "highly acceptable" nature of the equipment in terms of design, functionality, Keywords: and portability. Noteworthy attributes include its facilitation of pattern transfer to silkscreen Portable Photographic Silkscreenfor efficient mass production and its adaptable use of renewable energy, rendering it Pattern Equipment operational in diverse environments, including remote areas and educational institutions. Dual Power Source. The equipment's superior portability, robust construction, and systematic wiring Renewable Energy, organization enhance its practicality. Experimentally, processing silkscreen pattern Operational Adaptability. emulsion exhibits a minor time disparity between alternating current (AC) and solar battery power, with a mere one-minute difference (4 minutes on AC, 3 minutes on solar power). This study heralds a promising innovation in pattern transfer technology, poised to revolutionize mass production while championing sustainability and operational



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#### **I. INTRODUCTION**

adaptability.

In the pursuit of innovative solutions for modern production challenges, this study undertook the ambitious task of conceptualizing, designing, and crafting a portable photographic silkscreen pattern equipment fortified with a dual power source. The research set its sights on addressing the pressing need for an efficient and versatile tool to facilitate the transfer of patterns or designs onto silkscreens, enabling mass production with ease.

Engaging a cohort of 88 respondents hailing from diverse departments, comprising twenty individuals per department, alongside the insightful input from eight esteemed instructors and professors specialized in Drafting Technology at the Zamboanga City State Polytechnic College, this study navigated through the realms of design, functionality, and portability of the Portable Photographic Silkscreen Pattern Equipment with Dual Power Source. Employing a survey questionnaire and embracing a convenience sampling methodology, the research adeptly collected comprehensive data. The findings unequivocally resonate a unanimous verdict – the design, functionality, and portability of this cutting-edge equipment stand endorsed as "highly acceptable" by the discerning participants.

Notably, this groundbreaking equipment not only streamlines the process of transferring patterns onto silkscreens for mass production but also boasts the ingenious integration of renewable energy sources. This dual power feature renders it adaptable to diverse environments, including remote areas or educational institutions. Its remarkable portability, sturdy construction, and systematic wiring organization further enhance its practicality and convenience. Furthermore, the experimental phase of this project unearthed intriguing performance metrics, showcasing the equipment's efficiency. Processing the emulsion of silkscreen patterns exhibited a time disparity of merely one minute between the alternating current (AC) and solar battery power sources - a mere 4-minute operation on AC and 3 minutes on solar power.

The compelling results of this study herald a promising paradigm shift in the realm of pattern transfer technologies, showcasing the viability and efficacy of a portable, dual-powered solution poised to revolutionize mass production processes while championing sustainability and operational adaptability.

This set also establishes the research question, the objectives of the work and hypothesis, if necessary, the importance and limitations of the study. Establishes the method used at work. It is written in the present tense.

#### **II. THEORETICAL REFERENCE**

Screen printing is a traditional print technique that has been used for many years. In the screen-printing process, a type of stencil design is created on fine mesh or polyester fabric, with several layers of ink pushed through this stencil layout onto the surface of the print material. All the different ink colors are applied using a different screen stencil to create the final printed effect. Areas of the print material which need to be left clear are covered with an impermeable substance to prevent ink contamination [1].

The technique of silk-screen printing, also known as screen processing or screen printing, involves brushing ink onto a finemesh screen that holds the image to be printed, then forcing the image through the screen's openings. It's utilized for printing on glass, skis, surfing boards, credit cards, billboard posters, wallpaper patterns, writing on bottles and clothes, and printed circuit board pictures in the electronics sector. Irritating dermatitis can be brought on by potential irritants including inks and cleaning products. Organic solvents may have harmful side effects, including neurotoxicity. The true allergens listed in silk-screen printers include triglycidyl isocyanurate, epoxy resin, diaminodiphenyl-methane, and acrylate components of UV-curing chemicals, which are the most common allergies [2].

The study's goal is to investigate the various T-shirt printing techniques. Kushtia Zone is the one I have chosen to get my data from. Kushtia, a historic city, has long been known for its fabric printing industry. One of the occupations of the people of Kushtia is t-shirt printing. In Bangladesh, t-shirts are printed using a variety of techniques, including screen printing, heat transfer, and dye sublimation. In Bangladesh, however, screen printing is the most often used method. It is less expensive and simple to use. Even though screen printing is the best method in Bangladesh, there are obstacles in the way of its advancement. The printing process is laborious, and the final goods produced are of poor quality. Additionally, the "Portable T-shirt Printing Machine" has been created to reduce the issues that local printers have while screen printing. The 80 cm long, 50 cm wide, and 15 cm high portable tshirt printing machine is lightweight and portable, allowing for printing anywhere there is or is not electricity. The steel frame that is adjustable may be used to accommodate screens of any size, from 45 cm by 45 cm to 16 cm by 16 m or even smaller. The research methodology utilized in the qualitative, or descriptive, approach. 110 people make up the study's sample population, or 33% of the target population. Interviews, observations, and questionnaires were employed as the data collection methods. The study's primary conclusions were that developing a machine can speed up the conventional screen printing procedure. Additionally, there is a direct correlation between the speed and skill of the t-shirt printing process and the money made [3].

The dimensionless efficiency of incandescent lights, which typically ranges from 2% to 13%, may be calculated as a function

of filament temperature using Planck's radiation formula. Similarly, the efficacy of incandescent light bulbs is approximated as a function of temperature using the known spectrum luminous efficiency of the human eye, with values ranging from 8-24 L W-1 for bulbs with a power of 10-1000 W. The efficiency and efficacy results allow for the estimate of the filament temperature for any lamp with known efficacy, and they compare favorably with published data [4].

More efficient solar cells are just one use of advanced solar energy harvesting technology. There are possibilities for research and development in the related hardware used to store this sporadic resource on the grid and provide electricity from solar cells to households and businesses. Lewis examines the current state of these fields as well as solar thermal and solar fuels energy harvesting techniques [5].

#### **III. MATERIALS AND METHODS**

This study used experimental approach and quantitative research design to empirically analyze the data. Specifically, it made used of the descriptive statistics on the arithmetic mean was used to measure the value that represented their level acceptance in terms of the portability, functionality, and design of the portable photographic silkscreen pattern equipment with dual power source. There were eighty-eight (88) respondents selected from amongst the four (4) departments of the college namely the Techer Education Department, Institute of Technology Education, Department of Technology Education, and Department of Arts and Sciences were carefully analyzed using statistical tools.



Figure 1: Shows the Perspective View of the Portable Photographic Silkscreen Pattern Equipment with Dual Power. Source: Authors, (2025).

Table 1: Rating scale, mean range descriptive rating for the perceptions statements designed to determine the level of the acceptability of the portable photographic silkscreen pattern

#### ITEGAM-JETIA, Manaus, v.11 n.53, p. 12-15, May/June., 2025.

equipment with dual power source in term of, design, portability, and functionality.

Table 1: shows that in this study anything between 1.00 to 1.74 was interpreted as "strongly disagree", a mean score that fell between 1.75 to 2.49 was interpreted as "disagree" and mean score from 2.50 to 3.25 was interpreted as "agree: lastly, those that fell from 3.26 to 4.00 meant "strongly agree".

#### Manual Description of the

Mean range	Descriptive rating			
3.26 - 4.00	Strongly Agree			
2.50 - 3.25	Agree			
1.75 - 2.49	Disgree			
1.00 - 1.74	Storngly Disasgree			

Source: Authors, (2025).

#### **IV. RESULTS AND DISCUSSIONS**

Table 2: Drafting technology students evaluation result on the level of design acceptability on photographic printing silkscreen pattern equipment.

Statements		Departments		
		DT E	IT E	DAS
Portability				
1. A Portable Photographic Silk screen Pattern Equipment is well constructed as plan	3.8	3.8	3.8	3.75
2. The project is installed with casters for ease in mobility.	4.0	3.7	3.8	3.9
3. The materials used in the project is made of good quality.	3.8	3.7	3.7 5	3.7
4. The equipment is suitable for making pattern in printing process.	3.8	3.7	3.8 5	3.75
5. The electrical layout is well installed and organized.	4.0	3.6	3.8 5	3.75
6. The color of the equipment is pleasing and appropriate for classroom and industry use.	4.0	3.6	3.7 5	3.75
Mean:	3.90	3.6 8	3.8 0	3.14
Overall mean:		3.63		
Interpretation:	Strongly Agree			

Legend: (1.0 – 1.80 Strongly Disagree, 1.81 – 2.50 Disagree, 2.51 – 3.25 Agree, and 3.26 – 4.0 Strongly Agree) Source: Authors, (2025).

Table 2 (Drafting Technology Students Evaluation in terms of Design). There were six (6) statement to be rated in terms of design. Students from four (4) departments strongly agreed to the design of A Portable Photographic Silkscreen Pattern Equipment with Dual Power Source. To be specific, Teacher Education Department, Students rated a weight mean of 3.9, while students from Department of Technology Education rated a weight mean of 3.68, and also the Institute of Technical Education rated a weight mean of 3.8, lastly the Department of Arts and Science give a rate mean of 3.14 which gave an overall mean of 3.63 which signified strongly agreed interpretation among the students from the four (4) Department who evaluated this project. Table 3: Drafting technology students evaluation result on the level of acceptability on photographic silkscreen pattern equipment in terms of functionality.

Statamonta	Departments			
Statements	TED	DTE	ITE	DAS
Functionali	ty			
1. The equipment can operate	4.0	3.65	3.95	3.7
manually.				
2. The Portable Photographic				
Silkscreen pattern equipment with	it with 40		3 75	37
Dual power source produce	1.0	5.7	5.75	5.7
quality print out.				
3. The equipment can be operated				
through direct current by using	4.0	3.7	3.8	3.8
solar energy that stored to a solar				
gel battery.				
4. The wiring diagram is properly	3 95	3 55	37	38
installed.	5.75	5.55	5.7	5.0
5. The electrical layout is well	3 95	3 55	38	3 65
organized.	5.75	5.55	5.0	5.05
6. The Portable photographic		3.55	3.8	3.65
silkscreen pattern equipment with				
dual power source is using a	4.0			
reflector to increase the heat of the				
incandescent bulb.				
7. The Portable photographic			3.85	3.65
silkscreen pattern equipment with				
dual power source has an inverter	4.0	3.7		
installed to regenerate power from				
battery to produce a maximum				
power.				
Mean:	3.99	3.63	3.81	3.71
Overall mean:	3.78			
Interpretation:	Strongly Agree			

Legend: (1.0 - 1.80 Strongly Disagree, 1.81 - 2.50 Disagree,

2.51 – 3.25 Agree, and 3.26 – 4.0 Strongly Agree). Source: Authors, (2025).

Table 3 (Drafting Technology Students Evaluation in terms of functionality). There were seven (7) statement to be rated in terms of functionality. Students from four (4) selected departments strongly agreed to the functionality of the Portable Photographic Silkscreen Pattern Equipment with Dual Power Source. To be specific, Teacher Education Department students rated a weight mean of 3.99, while students from Department of Technology Education rated a weight mean of 3.63, and also the Institute of Technical Education rated a weight mean of 3.81, lastly the Department of Arts and Science give a rate mean of 3.71 which gave an overall mean of 3.78 which signified strongly agreed on functionality of photographic silkscreen pattern equipment among the students from the four (4) Department who evaluated this project. The development of the photographic silkscreen pattern equipment functionality carefully considered the following: locally made, materials availability, cost-efficiency, and replicability. This is in accordance with the findings of S.A Onasanya in 2003, states "that possible to produce effective and qualitative instructional media in Nigeria and that locally produced hardware could also be produced at a relatively competitive rate with the imported ones" [6].

#### ITEGAM-JETIA, Manaus, v.11 n.53, p. 12-15, May/June., 2025.

Table 4: Drafting technology students evaluation result on the level of acceptability on photographic printing silkscreen pattern equipment in terms of portability.

Statements		Departments		
		DT E	IT E	DAS
Portability				
<ol> <li>A Portable Photographic Silk screen Pattern Equipment with Dual power source is made of light materials.</li> </ol>	4.0	4.0	4.0	3.75
2. The equipment is easier to carry by using the stroller handle and two placement holders at left and right side of the equipment for easy handling.	4.0	4.0	4.0	3.75
3. The drawer compartment are used for convenient replacement of materials and also it can be used as ventilation purposes.	4.0	4.0	3.0	3.75
4. A Portable Photographic silkscreen pattern equipment with Dual power has four rollers installed for pushing purposes.	4.0	4.0	4.0	3.75
5. The size of the equipment is well constructed according to materials specification.	4.0	4.0	4.0	3.75
Mean:	4	4	3.8	3.75
Overall mean:	3.89			
Interpretation:	Strongly Agree			

**Legend:** (1.0 – 1.80 Strongly Disagree, 1.81 – 2.50 Disagree, 2.51 – 3.25 Agree, and 3.26 – 4.0 Strongly Agree). Source: Authors, (2025).

Table 4 (Drafting technology students are evaluated for Portability). In terms of design, there were seven (7) statements to be evaluated. The design of the Portable Photographic Silkscreen Pattern Equipment with Dual Power Source was enthusiastically supported by students from four (4) chosen departments. To be more precise, the Department of Teacher Education students gave this project a weight mean of 4.0, the Department of Technology Education students gave it a weight mean of 4.0, the Institute of Technical Education students gave it a weight mean of 3.80, and the Department of Arts and Science students gave it a weight mean of 3.75.

This resulted in an overall mean of 3.89, which indicated that the students from the four (4) Departments who evaluated this project had a strongly agreed on the portability of the on photographic printing silkscreen pattern equipment. It is important for an equipment made to be portable so that it can easily be moved from one place to another aside from that it can meet the industry demands in mass production of a product design in doing that, increased in the income follows. This is in conformity with the study of Selase et all in 2017 states that: *"the speed of the traditional screen-printing process can be increased when a machine is developed. Also, the fastness and efficiency of the t-shirt printing process have a direct relation with the income earned"* [7].

#### **V. CONCLUSIONS**

Teachers and students can both utilize the portable photographic silkscreen pattern equipment with a dual power supply for demonstrations inside or outside of the classroom as educational tools to produce high-quality results. They can be used for demonstration in printing T-shirt and other silk materials; it can also transfer the design clearly and produce quality output. The installed wheels may also help for ease in mobility and lastly, the device has a dual power source to avoid the effect of power interruptions.

The components of the equipment assembled in this project are constructed according to each function. The electrical wirings of the equipment are safely installed and work properly. A Portable Photographic Silkscreen Pattern Equipment with Dual Power Source Materials is Available in Any Enterprise. The portable photographic silkscreen pattern equipment with dual power source can operate from direct current (AC) power and solar energy because it has a solar gel battery that serves as energy storage and comes from the solar panel. The top surface of the equipment can be used as a table for the printing shirt process. The respondents of this study agreed with its portability, design, and functionalities.

Due of its portability and low cost, the project can be commercialized. Battery controller is required for the solar panel and solar gel battery. The project provides as study material for upcoming researchers. Experts advised that the battery and inverter should be compatible to prevent unnecessary costs. If the professionals are consulted, you may also utilize LED, fluorescent, and halogen bulbs. The building's layout may be made better. Experts strongly advise using solid wire. Speaker wire can be stretched by a minimum of two meters. For additional enhancements, the project's color can be changed. The apparatus can also be made more portable.

#### VI. AUTHOR'S CONTRIBUTION

**Conceptualization:** Halima A. Sahim-Sali, Joshua R. Apolinario and Anna rose A. Amalan.

Methodology: Halima A. Sahim-Sali and Ernesto F. Bantug.

**Investigation:** Spencer vape A. Gregorio and Kevin C. Maningo. **Discussion of results:** Halima A. Sahim-Sali, Joshua R. Apolinario and Spencer vape A. Gregorio.

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Writing – Review and Editing: Halima A. Sahim-Sali and Kevin C. Maningo

Resources: Anna rose A. Amalan.

**Supervision:** Halima A. Sahim-Sali and Joshua R. Apolinario. **Approval of the final text:** Halima A. Sahim-Sali, Kevin C. Maningo and Ernesto F.Bantug.

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