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Development of Mini Silk Screen Printing Machine

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ABSTRACT

The research aims to develop and design a mini semi-automatic screen-printing system that can be easily controlled. The objectives of this project are to create a suitable design for the mini semi-auto screen printing system and to develop it accordingly. The type of study conducted is the development of a real project, which is the production of a mini silk screen printing machine. The development of this project involves 4 phases: design and fabrication phase, motor wiring system, mould production and testing process. In this project, a mechanical setup will be created to execute the printing process. This setup will include a conveyor mechanism to hold the paper, a lifting arrangement, a wiping setup, and cutters. To control the printing operation and semi-automate the screen-printing setup, a power panel will be utilized. The setup will encompass a control system and a motion system, which will consist of a gear assembly and servo motors. The testing conducted is the functional process of the system regarding machine operation. As a conclusion, the development of mini silk screen printing successfully develops for student in Mechanical Engineering Department in POLIMAS.

Keywords: *Silk screen printing, printing process, control system.*

I. INTRODUCTION

Screen printing is a technique used to transfer ink onto a substrate using a mesh. Areas that should not receive ink are blocked by a stencil. To fill the open mesh apertures with ink, a blade or squeegee is moved across the screen. Then, the screen briefly touches the substrate along a line of contact in a reverse stroke. This allows the ink to wet the substrate and be pulled out of the mesh apertures as the screen springs back. Only one colour is printed at a time, so multiple screens are used to create a multi-coloured image or design. This technique has various names, including screen printing, silkscreen printing (due to the use of silk in the past), serigraphy, and serigraph printing. Nowadays, synthetic threads like polyester are commonly used in the screen-printing process. [1]– [3].

Screen printers also have access to special-use mesh materials made of nylon and stainless steel. The choice of mesh size is important as it determines the final appearance of the design on the material. Figure 1 shows the silk screen printing machine.

Figure 1: Silk screen printing machine

II. METHODOLOGY

1. Silk Screen Printing

Screen printing is a versatile method used to print on a variety of items, including technical textiles, clothing and footwear fabrics, leather goods, furnishings, household textiles, and decorative textiles. It is also applicable to textiles used in industries like aeronautics, medical, electronics, and automotive. Additionally, screen printing can be done on surfaces made of paper, cardboard, polymeric materials, wood, metal, leather, and non-woven substitutes [4], [5].

Screen printing is widely considered to be the most versatile printing process. It can be used on a wide range of materials, including paper, paperboard, plastics, glass, metals, fabrics, nylon, and cotton. The screen-printing industry produces various products, such as posters, labels, decals, signage, textiles, and electronic circuit boards. One of the main advantages of screen printing is its ability to print on substrates of any shape, thickness, and size.

The technique of screen-printing dates back almost 2000 years to China, where human hair stretched across a wooden frame was used as the screen. Stencils made from leaves were attached to the screen to create different shapes. The Japanese later adopted screen printing and used woven silk for the mesh and lacquers for stencils. This is why screen printing is also known as silk screening or silk screen printing. The process involves three main elements: the screen, which carries the image to be printed, the squeegee, and the inks. Screen printing can be used on various surfaces [6], [7].

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2. Design and fabrication phase

The design and fabrication process begins with designing the machine and fabricating the frame of the mini silk screen printing machine. The design and fabrication process of the mini silk screen printing machine typically involves several steps as follows:

Machine Design: This process starts with the development of the initial concept for the mini silk screen printing machine. It involves determining the machine size, the type of materials to be used, necessary components, and other essential functions. This design process is usually carried out using computer-aided design software such as AutoCAD.

Machine Frame Fabrication: After the machine design is completed, the next step is the fabrication of the machine frame. This involves cutting, welding, and assembling materials such as metal or other necessary materials to form the machine frame.

Figure 2 shows the specification design of mini silk screen printing machine.

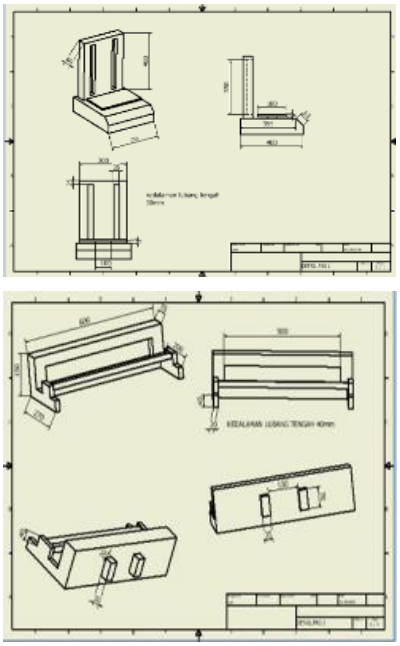

Figure 2. Specification design of mini silk screen printing machine.

3. Motor Wiring System

The figure 3 shows the process of motor wiring system. The setup will encompass a control system and a motion system, which will consist of a gear assembly and servo motors.

Figure 3: The process of motor wiring system.

4. Mould Production

Figure 4. The process of mould production

The figure 4 shows the process of mould production. The stencil box made from wood that have been cut into a shape of box. The canvas layer is attached onto the stencil box and the logo CMeP attach to the canvas.

5. Testing Process

Testing of the system needs to be conducted to ensure that the developed machine can function properly and achieve the objectives of this study. The testing conducted is the functional process of the system regarding machine operation. The testing instrument used is a checklist form.

a) Power source testing

b) Control Button testing ON/ OFF

c) Stencil mould block testing

d) Testing of machine

e) The product printing

Figure 5. shows the testing process for mini silk screen printing machine.

III. RESULTS AND DISCUSSION

The table 2 shows several findings from the functionality test result that can be conducted by the mini silk screen printing machine.

Table 2. Mini Silk Screen Printing Functionality Test Results.

Process	Status
Turn on the device by pressing the ON switch	Successful
Printing process runs smoothly	Successful
The printing ink appears on the product	Successful
Users need to manually remove the printed output	Successful
Machine functions properly	Successful
Turn off the device by pressing the OFF switch	Successful

From the analysis shows that functionality of mini silk screen printing has been successful and the machine can be used for printing.

IV. CONCLUSION

The innovation has been successfully implemented to achieve the objectives and scope requirements. The research objective is to develop a silk screen printing machine that can be used by students at POLIMAS. Among the advantages of producing this project are its portability and ease of storage, and the prints can be customized according to user needs. However, for improvement for the machine is that students need to prepare designs that fit the size of the stencil box.

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