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Design and Fabrication of a Screen Printing Machine

A Thesis
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January, 2025

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In partial fulfillment of the requirement for award of the degree of
Bachelor of Science in Mechanical Engineering

January, 2025

LETTER OF TRANSMITTAL

January, 2025

To

Nuruzzaman Rakib

Assistant Professor

Department of Mechanical Engineering.

Sonargaon University

Subject: Submission of Project Report**.**

Dear Sir,

We are pleased to submit the project report on **"Design and Fabrication of a Screen Printing Machine".** It was a great pleasure to work on such an important topic. This project has been done as per instruction of your supervision and according to the requirements of the Sonargaon University.

We expect that the project will be accepted by the concerned authority we will remain happy to further explanation that you may feel necessary in this regard.

Thank You

Sincerely yours,

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DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for award of any degree or certificate

We hereby ensure that the works that has been prevented here does not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from breach of the foregoing obligation.

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The authors are also grateful to **Professor Md. Mostofa Hossain,** Head of the Department of Mechanical Engineering and all respect teachers of the Mechanical Engineering Department for their co-operation and significant help for completing the thesis work successfully.

ABSTRACT

The Design and Fabrication Screen Printing Machine is a state-of-the-art innovation designed for precision and efficiency in high-volume printing. This machine automates the entire screen printing process, eliminating manual errors and ensuring consistent results across various materials such as textiles, plastics, and metals. It integrates advanced drying technology, enabling rapid ink curing and seamless workflow without the need for external drying equipment. Featuring a servo-driven system, it offers precise control over alignment, pressure, and speed, ensuring high-quality outputs with minimal waste. The machine's user-friendly interface allows for easy operation and customization, accommodating diverse printing requirements. Its energy-efficient design and compatibility with eco-friendly inks support sustainable production practices. Ideal for industrial applications, the Fabrication and Development Automatic Screen Printing Machine significantly enhances productivity, reduces operational costs, and delivers exceptional reliability. This innovative solution meets the demands of modern manufacturing, making it a cornerstone for businesses seeking efficient and sustainable printing technologies.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

A Screen Printing Machine represents a significant advancement in the screen printing industry, offering high-speed, precise, and efficient printing solutions. Unlike traditional screen printing methods, this machine eliminates the need for drying screens between prints, which drastically reduces production time and operational complexity. Designed for various applications, including textiles, ceramics, glass, and promotional items, it ensures consistent and high-quality results for diverse materials and designs.



Figure 1.1: Screen Printing Machine

Ref: https://systauto.com/screen-printing-machines/model-sst-automatic-screen-printer/

Equipped with advanced digital controls and precise registration systems, the Automatic Screen Printing Machine allows for seamless adjustments, enabling users to handle intricate patterns and multi-color designs with ease. Its robust construction and automated functionality make it suitable for high-volume production, significantly reducing labor costs and increasing output efficiency. The machine also minimizes waste and errors, ensuring that materials and resources are utilized optimally. User-friendly features such as a digital

interface, programmable settings, and automated cleaning functions further enhance its appeal, making it accessible even to operators with minimal experience. Additionally, its eco-friendly design reduces water and chemical usage, aligning with modern sustainable manufacturing practices. Ideal for businesses seeking to boost productivity and maintain consistent quality, the Dry Automatic Screen Printing Machine is a game-changer in industrial printing solutions.

1.2 Problem Statement

Traditional screen printing processes often face challenges such as high labor costs, inconsistent quality, and time-consuming operations due to the need for manual intervention and drying between prints. These inefficiencies can result in increased production time, material waste, and higher operational costs, limiting scalability and profitability. Additionally, conventional methods may lack the precision required for intricate designs and multi-color prints. The lack of automation also reduces productivity, especially in high-volume production settings. This project addresses these issues by developing a Dry Automatic Screen Printing Machine that eliminates drying delays, enhances printing precision, and optimizes resource utilization, ensuring faster, cost-effective, and eco-friendly printing operations.

1.3 Objectives

We have some specific objectives for this project and they are pointed below:

- To design and construct of a Screen Printing Machine.
- To analysis the performance of a Screen Printing Machine.
- To take necessary notes from the project for future improvements.

1.4 Structure of the Project

This Project is organized as follows:

Chapter 1 Introduction**:** The first chapter contains the statement of the introduction, problem statement, objectives of the study and the project outline.

Chapter 2 Literature Review**:** The chapter two contains our introduction, literature review part.

Chapter 3 Methodology**:** Chapter three describes the theoretical model. Here we mainly discuss about block diagram, circuit diagram, Basic Drawing, project working principle, complete project image etc...

Chapter 4 Hardware Analysis**:** Chapter four describes the theoretical model. Here we mainly discuss about proposed system Hardware and software development of our project etc.

Chapter 5 Result and Discussion**:** Chapter five deals with the result and discussion and discuss about our project advantages and application.

Chapter 6 Conclusion**:** Chapter six all about our project conclusion and future scope.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter is arranged on Literature Review. Here's a look at some of last year's literature, like our project. By reading them, we can overcome the mistakes of the previous project and make a more effective project.

2.2 Literature Review

The reference papers and literature surveys show us that the quality of the screen print depends on the surface on which the design is being printed. The print quality is determined by various factors such as, quality of material, flatness of bed, the type of ink used, the mesh size and the printing support configuration. We need to design a print bed that is perfectly flat, and thus get the best quality print possible. This is also helped by the fact that we are using an automatic mechanism, which makes calculation of distances easier than it would be otherwise, if it was a manual system. We have the capability to find a squeegee capable of applying enough pressure so that no tearing of screen occurs. Realizing about various methods of production of the film, we could find the best method of producing a stencil/design effectively, and capable of handling the amount of force exerted on it during the printing process. Learned various methods of reproduction of the screens that gives us the optimal and cost-effective design. We found out the challenges faced while transporting the film, and how the industry has made progress in automobile paint and screen-printing technology, which enables us to expand our horizon and take influence from designs used in those processes.

Screen printing is a widely used technique for transferring images onto various substrates, including textiles, glass, and ceramics. Traditional methods often involve manual intervention, which can lead to inefficiencies and inconsistent quality. Recent advancements focus on automating the process to improve precision and reduce operational costs (Smith & Jones, 2018).

The introduction of automation in screen printing has transformed the industry by eliminating manual steps, such as screen drying and alignment. Automated machines

equipped with digital controls and robotic arms offer enhanced speed and accuracy, making them suitable for high-volume production (Johnson et al., 2019). Studies highlight how automation reduces material waste and ensures consistent print quality across batches.
Dry printing methods eliminate the need for intermediate drying stages, saving time and energy. These machines use advanced ink formulations and curing technologies, such as UV curing, to ensure rapid drying and adhesion. This innovation significantly reduces production downtime, making it an eco-friendly alternative (Chen & Lee, 2020)

Sustainability is a growing concern in manufacturing industries. Modern screen printing machines are designed to use less water and chemicals, aligning with green manufacturing goals. Literature suggests that integrating eco-friendly features in automated machines can enhance their market appeal (Williams, 2021).

Cost-effectiveness remains a critical factor in adopting new technologies. Automated dry screen printing machines have been shown to reduce labor costs, improve throughput, and decrease material wastage, offering a high return on investment (Brown & Davis, 2022).

2.3 Summary

The above has been discussed in detail in the past few literatures' which has given us a lot of motivation to do this project.

CHAPTER 3
METHODOLOGY

3.1 Methodologies of the project

Creating an idea for Design and Fabrication of a Screen Printing Machine and designing a block diagram & circuit diagram to know which components need to construct it. Collecting all the components and do programming for the micro controller to control the system. Collecting all the components/materials for construct the system.

3.2 Block Diagram

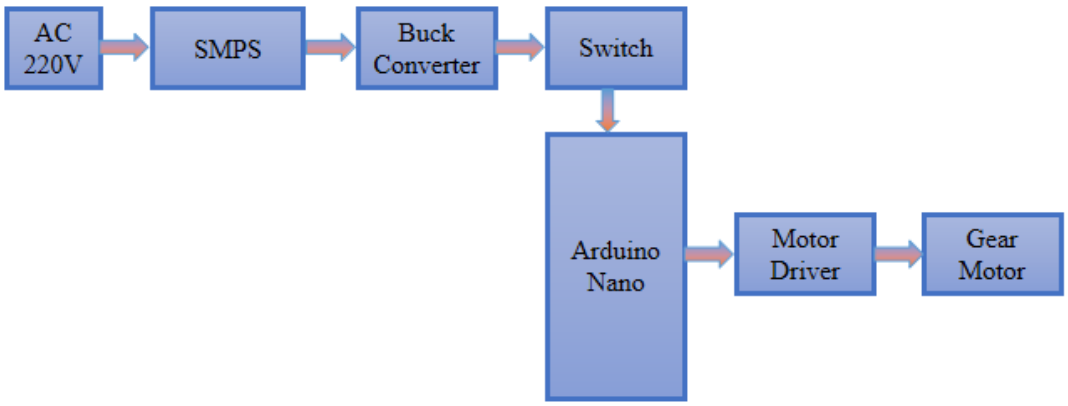


Figure 3.1: Block Diagram of Screen Printing machine

3.3 Circuit Diagram of proposed Model:

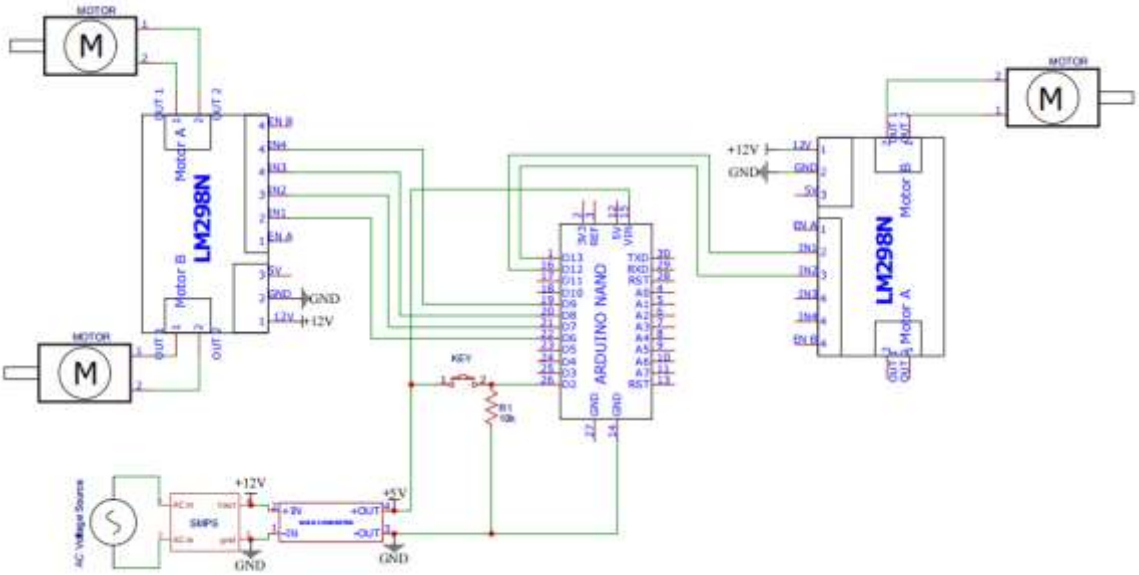


Figure 3.2: Circuit Design of Screen Printing machine

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3.4 Working Principle

The Screen Printing Machine functions by integrating electrical, mechanical, and control components to achieve precision and automation. The system is powered by an SMPS (Switched Mode Power Supply), which provides stable DC voltage to all electronic components. A buck converter steps down the voltage as required, ensuring the safe operation of the Arduino Nano, the control unit of the system. When a switch is activated, the Arduino Nano processes the input and controls the motor driver, which in turn drives the gear motor. The gear motor, connected to a pulley system, enables smooth and controlled movement of the screen printing platform. This mechanism ensures precise alignment and pressure during ink transfer onto the substrate. The integrated drying system operates simultaneously, ensuring quick ink curing. The coordination of these components results in consistent, high-quality prints with efficient energy use, making it ideal for automated screen printing applications.

3.5 Basic Drawing of System

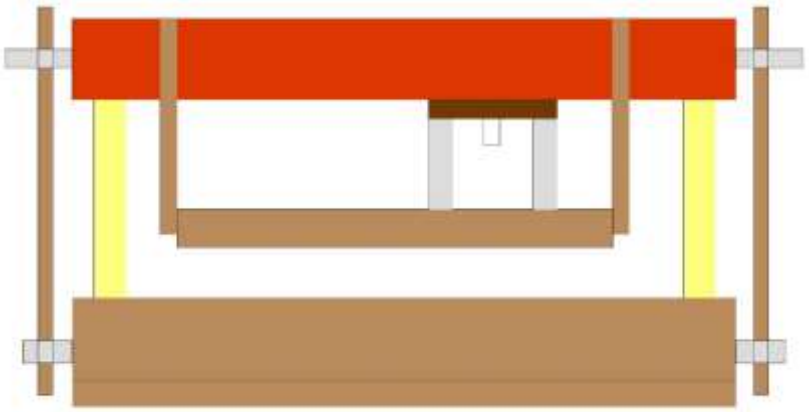


Figure 3.3: Basic Drawing of Front View

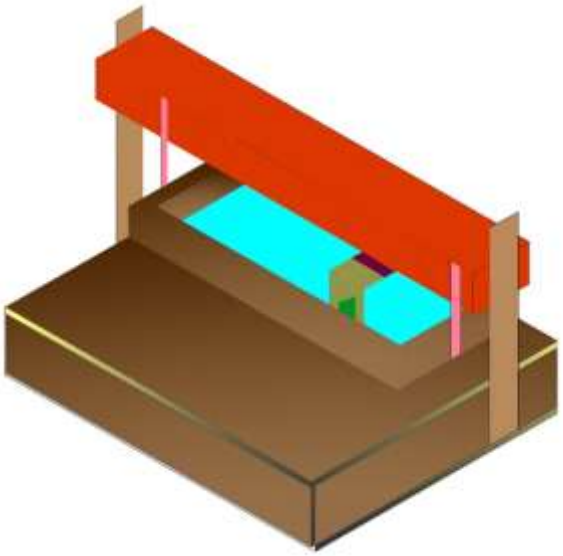


Figure 3.4: 3D View

3.6 Real View of project



Figure 3.5: Project Prototype

CHAPTER 4
HARDWARE ANALYSIS

4.1 Introduction

In this section, we will discuss elaborately about our hardware design of "**Oil Skimmer**" and the component description, features, working procedure and description of our all equipment.

Hardware

- SMPS
- Gear Motor
- Pulley
- Buck Converter
- Arduino Nano
- Motor Driver
- Switch

4.2 Switch Mode Power Supply (SMPS)

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. A hypothetical ideal switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time (also known as duty cycles). In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply.

Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight.



Figure 4.1: SMPS

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; their switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor. Switched-mode power supplies are classified according to the type of input and output voltages. The four major categories are:

- AC to DC
- DC to DC

A basic isolated AC to DC switched-mode power supply consists of:

- Input rectifier and filter
- Inverter consisting of switching devices such as MOSFETs
- Transformer
- Output rectifier and filter
- Feedback and control circuit

The input DC supply from a rectifier or battery is fed to the inverter where it is turned on and off at high frequencies of between 20 KHz and 200 KHz by the switching MOSFET or power transistors. The high-frequency voltage pulses from the inverter are fed to the transformer primary winding, and the secondary AC output is rectified and smoothed to produce the required DC voltages. A feedback circuit monitors the output voltage and

instructs the control circuit to adjust the duty cycle to maintain the output at the desired level.

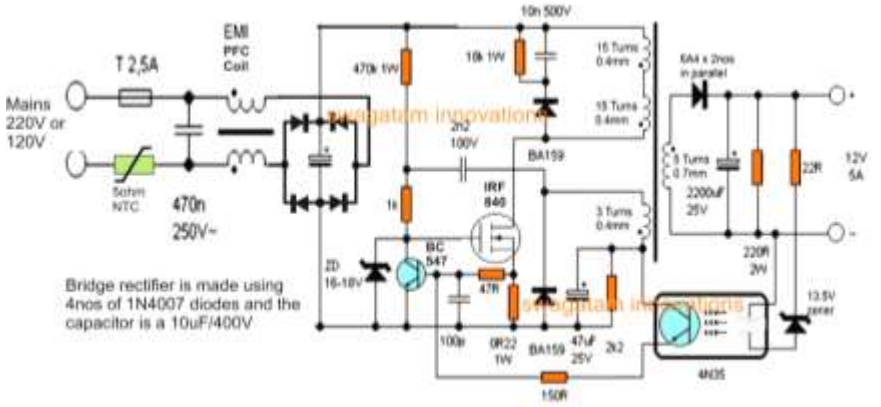


Figure 4.2: SMPS Circuit

Basic working concept of an SMPS

A switching regulator does the regulation in the SMPS. A series switching element turns the current supply to a smoothing capacitor on and off. The voltage on the capacitor controls the time the series element is turned. The continuous switching of the capacitor maintains the voltage at the required level.

Design basics

AC power first passes through fuses and a line filter. Then it is rectified by a full-wave bridge rectifier. The rectified voltage is next applied to the power factor correction (PFC) pre-regulator followed by the downstream DC-DC converter(s). Most computers and small appliances use the International Electro technical Commission (IEC) style input connector. As for output connectors and pin outs, except for some industries, such as PC and compact PCI, in general, they are not standardized and are left up to the manufacturer.

There are different circuit configurations known as topologies, each having unique characteristics, advantages and modes of operation, which determines how the input power is transferred to the output. Most of the commonly used topologies such as fly back, push-pull, half bridge and full bridge, consist of a transformer to provide isolation, voltage scaling, and multiple output voltages. The non-isolated configurations do not have a transformer and the power conversion is provided by the inductive energy transfer.

Advantages of switched-mode power supplies:

- Higher efficiency of 68% to 90%
- Regulated and reliable outputs regardless of variations in input supply voltage
- Small size and lighter
- Flexible technology
- High power density
- Disadvantages:
- Generates electromagnetic interference
- Complex circuit design
- Expensive compared to linear supplies

Switched-mode power supplies are used to power a wide variety of equipment such as computers, sensitive electronics, battery-operated devices and other equipment requiring high efficiency. Linear voltage IC regulators have been the basis of power supply designs for many years as they are very good at supplying a continuous fixed voltage output. Linear voltage regulators are generally much more efficient and easier to use than equivalent voltage regulator circuits made from discrete components such a sneer diode and a resistor, or transistors and even op-amps. The most popular linear and fixed output voltage regulator types are by far the 78… positive output voltage series, and the 79… negative output voltage series.

These two types of complementary voltage regulators produce a precise and stable voltage output ranging from about 5 volts up to about 24 volts for use in many electronic circuits. There is a wide range of these three-terminal fixed voltage regulators available each with its own built-in voltage regulation and current limiting circuits. This allows us to create a whole host of different power supply rails and outputs, either single or dual supply, suitable for most electronic circuits and applications. There are even variable voltage linear regulators available as well providing an output voltage which is continually variable from just above zero to a few volts below its maximum voltage output.

Switch Mode Power Supply

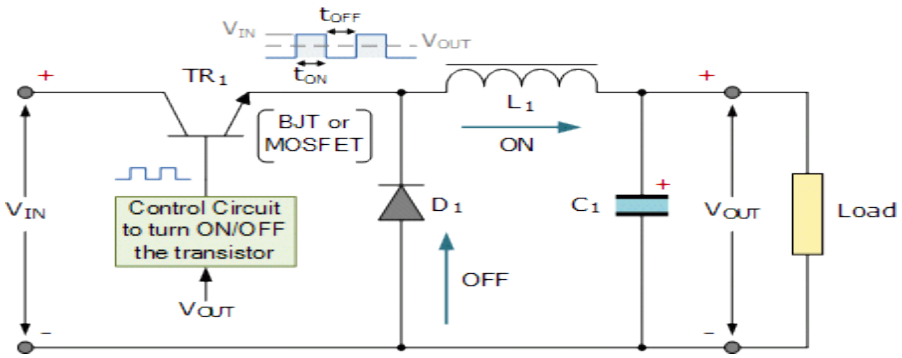


Figure 4.3: SMPS Circuit Connection

Most DC power supplies comprise of a large and heavy step-down mains transformer, diode rectification, either full-wave or half-wave, a filter circuit to remove any ripple content from the rectified DC. Producing a suitably smooth DC. voltage, and some form of voltage regulator or stabilizer circuit, either linear or switching to ensure the correct regulation of the power supplies output voltage under varying load conditions. Then a typical DC. Power supply would look something like this:

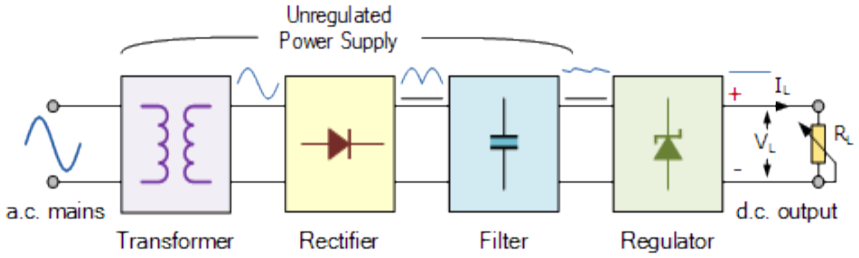


Figure 4.4: DC Power supply way

These typical power supply designs contain a large mains transformer (which also provides isolation between the input and output) and a dissipative series regulator circuit. The regulator circuit could consist of a single zener diode or a three-terminal linear series regulator to produce the required output voltage. The advantage of a linear regulator is that the power supply circuit only needs an input capacitor, output capacitor and some feedback resistors to set the output voltage.

4.3 DC Gear Motor

A **DC gear motor** combines a DC motor with a gearbox to deliver controlled speed and torque, making it ideal for applications requiring precise movement and power. The motor

converts electrical energy into mechanical motion, while the gearbox reduces speed and increases torque. This configuration enhances performance in robotics, automation, and industrial machinery. DC gear motors are available in a variety of sizes, voltages, and torque ratings to suit diverse needs. Their efficient and reliable operation, compact design, and ability to handle varying load conditions make them a popular choice for tasks demanding accuracy and durability in motion control systems.



Figure 4.5: DC Gear Motor

Specification:

- Voltage:12V DC
- Gear ratio: 1/31
- No-load speed: 200RPM
- Rated Speed: 140RPM
- Rated torque: 10kg.cm
- Rated current: 2.5Amp
- Length of Motor (including spindle): 106mm/4.17″
- Diameter: 37mm/1.45″
- Shaft length: 21mm/0.82″
- Shaft diameter: 6mm/0.24″

4.4 Pulley

A **pulley** is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In

the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave.



Figure 4.6: Pulley

Table 01: Pulley Product Specification

Product Type	**Motor Pulley**
Size	5mm
Height	25mm
Outer diameter	12.2mm/0.48
Pitch Diameter	12.7mm/0.5

4.5 Arduino Nano

Arduino is open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling Lights, motors, and other actuators.

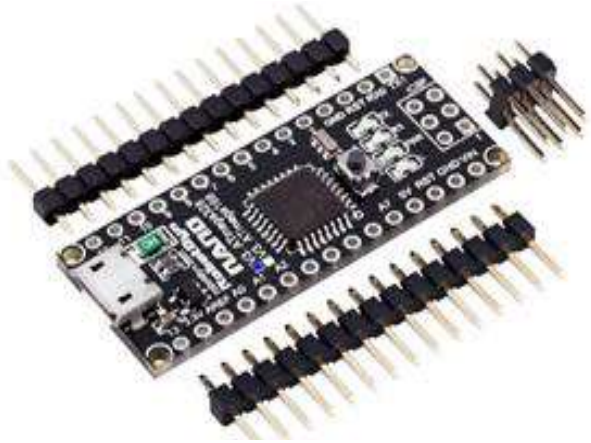


Figure 4.7: Arduino Nano

The micro-controller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, Maxims'). Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a small, complete, and breadboard friendly component. It has everything that Decimal has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano can automatically sense and switch to the higher potential source of power.

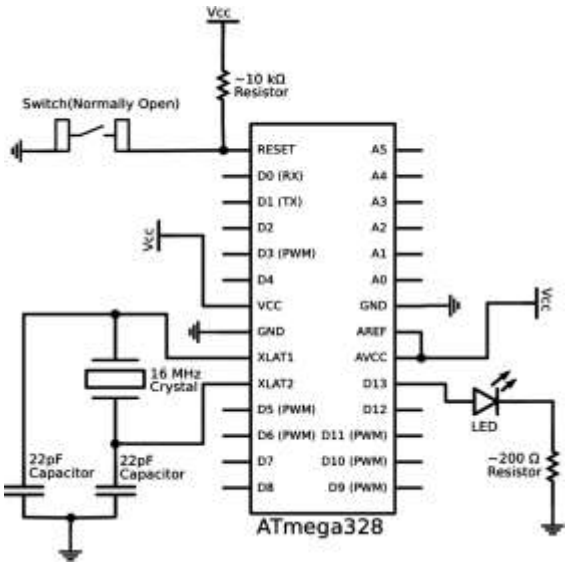


Figure 4.8: Arduino Nano Schematic Diagram

Nano's got the breadboard-ability of the Boarding and the Minibus with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, and GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It has two layers. That make it easier to hack and more affordable. One of the best features of Arduino Nano is, it's easy to use, compact and also small.

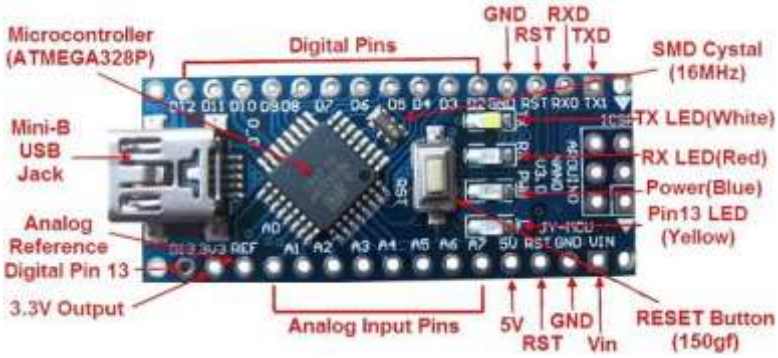


Figure 4.9: How Arduino Nano looks like

Specifications:

- Micro-controller: Atmel ATmega328
- Operating Voltage (logic level): 5 V
- Input Voltage (recommended): 7-12 V
- Input Voltage (limits): 6-20 V

- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 8
- DC Current per I/O Pin: 40 mA
- Flash Memory: 32 KB (of which 2KB used by boot loader)
- SRAM : 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Dimensions: 0.70” x 1.70”

Features:

- Automatic reset during program download
- Power OK blue LED
- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small mini-B USB for programming and serial monitor
- ICSP header for direct program download
- Manual reset switch

Micro-controller IC ATmega328p



Figure 4.10: Micro-controller IC AT mega 328p

The high-performance Microchip Pico Power 8-bit AVR RISC-based micro-controller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable

watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughput's approaching 1 MIPS per MHz, balancing power consumption and processing speed.

4.6 Switch:

A switch that has a single input and two dissimilar outputs is known as SPDT. The term SPDT stands for Single Pole Double Throw Switch which is used to control two dissimilar circuits through a similar single input. The operating of this switch can be done manually or included through the electromagnetic coil.



Figure 4.11: Switch

SPDT Switch Applications:

- This switch is used in a three-way circuit for controlling a load from two locations like from the top and bottom of a staircase.
- This switch is used to control two different circuits through a similar single input.
- Control Circuit.
- ABB/Siemens VFDs.
- PLC system output switches.
- Selector switches through a single common arrangement.

4.7 Buck Converter

A **buck converter** (**step-down converter**) is a DC-to-DC power converter which steps down voltage (while drawing less average current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) typically containing at least two semiconductors (a diode and a transistor, although modern buck converters frequently replace the diode with a second transistor used for synchronous rectification) and at least one energy storage element, a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter). It is called a buck converter because the voltage across the inductor "bucks" or opposes the supply voltage.



Figure 4.12: DC -DC Buck Converter

DC-DC Buck Converter Step down Module LM2596 Power Supply is a step-down (buck) switching regulator, capable of driving a 3-A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and an adjustable output version. The LM2596 series operates at a switching frequency of 150 kHz, thus allowing smaller sized filter components than what would be required with lower frequency switching regulators.

Specifications of DC-DC Buck Converter Step Down Module LM2596 Power Supply:

- Conversion efficiency: 92%(highest)
- Switching frequency: 150KHz
- Output ripple: 30mA9maximum)

- Load Regulation: ± 0.5%
- Voltage Regulation: ± 0.5%
- Dynamic Response speed: 5% 200uS
- Input voltage:4.75-35V
- Output voltage:1.25-26V(Adjustable)
- Output current: Rated current is 2A, maximum 3A (Additional heat sink is required)
- Conversion Efficiency: Up to 92% (output voltage higher, the higher the efficiency)
- Switching Frequency: 150KHz
- Rectifier: Non-Synchronous Rectification
- Module Properties: Non-isolated step-down module (buck)
- Short Circuit Protection: Current limiting, since the recovery
- Operating Temperature: Industrial grade (-40 to +85) (output power 10W or less)

4.8 Motor Driver

Motor Driver

The **LM298N** is a popular 16-Pin **Motor Driver** IC. As the name suggests it is mainly used to drive **motors**. A single **LM298N** IC is capable of running two DC **motors** at the same time; also the direction of these two **motors** can be controlled independently.

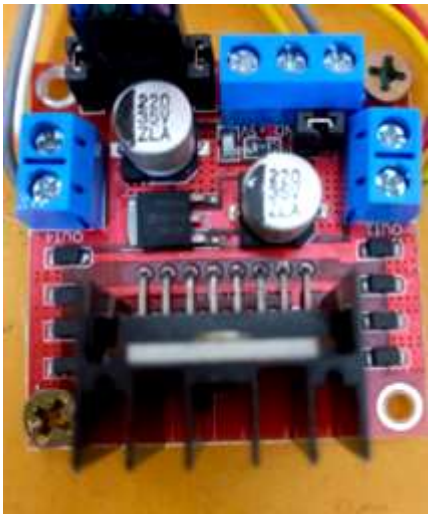


Figure 4.13: Motor driver

Working Process

LM298N IC is a typical **Motor Driver** IC which allows the DC **motor** to drive on any direction. This IC consists of 16-pins which are used to control a set of two DC **motors** instantaneously in any direction. It means, by using a **LM298N** IC we can control two DC **motors**.

Features

- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible
- Motor voltage Vcc2 (Vs): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to Vcc1(vss): 4.5V to 7V
- Transition time: 300ns (at 5Vand 24V)
- Automatic Thermal shutdown is available

L298N Pin Configuration

Table 02: Motor Driver Pin out

Pin Number	Pin Name	Description
1	Enable 1,2	This pin enables the input pin Input 1(2) and Input 2(7)
2	Input 1	Directly controls the Output 1 pin. Controlled by digital circuits
3	Output 1	Connected to one end of Motor 1
4	Ground	Ground pins are connected to ground of circuit (0V)
5	Ground	Ground pins are connected to ground of circuit (0V)
6	Output 2	Connected to another end of Motor 1
7	Input 2	Directly controls the Output 2 pin. Controlled by digital circuits
8	Vcc2 (Vs)	Connected to Voltage pin for running motors (4.5V to 36V)

9	Enable 3,4	This pin enables the input pin Input 3(10) and Input 4(15)
10	Input 3	Directly controls the Output 3 pin. Controlled by digital circuits
11	Output 3	Connected to one end of Motor 2
12	Ground	Ground pins are connected to ground of circuit (0V)
13	Ground	Ground pins are connected to ground of circuit (0V)
14	Output 4	Connected to another end of Motor 2
15	Input 4	Directly controls the Output 4 pin. Controlled by digital circuits
16	Vcc2 (Vss)	Connected to +5V to enable IC function

Use of a LM298N Motor Driver IC:

Using this LM298N motor driver IC is very simple. The IC works on the principle of **Half H-Bridge**, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a setup which is used to run motors both in clock wise and anti-clockwise direction. As said earlier this IC is capable of running two motors at the any direction at the same time, the circuit to achieve the same is shown below.

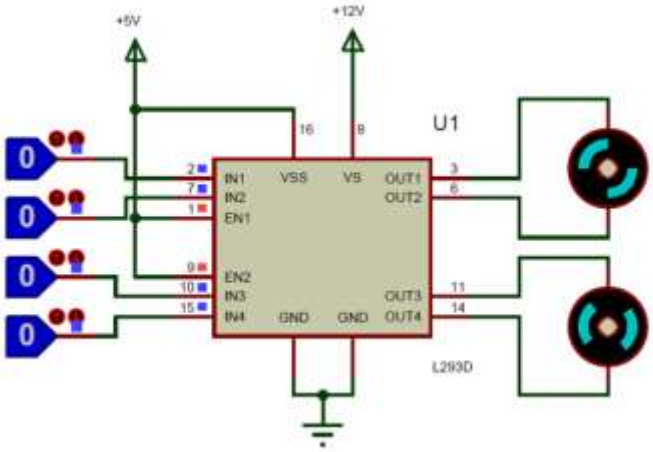


Figure 4.14: LM298N circuit Diagram

All the Ground pins should be grounded. There are two power pins for this IC, one is the Vss (Vcc1) which provides the voltage for the IC to work, this must be connected to +5V. The other is Vs(Vcc2) which provides voltage for the motors to run, based on the specification of your motor you can connect this pin to anywhere between 4.5V to 36V, here I have connected to +12V.

The Enable pins (Enable 1, 2 and Enable 3, 4) are used to Enable Input pins for Motor 1 and Motor 2 respectively. Since in most cases we will be using both the motors both the pins are held high by default by connecting to +5V supply. The input pins Input 1,2 are used to control the motor 1 and Input pins 3,4 are used to control the Motor 2. The input pins are connected to the any Digital circuit or micro-controller to control the speed and direction of the motor.

Applications

- Used to drive high current Motors using Digital Circuits
- Can be used to drive Stepper motors
- High current LED's can be driven
- Relay Driver module (Latching Relay is possible)

4.9 Arduino IDE

The digital microcontroller unit named as Arduino Nano can be programmed with the Arduino software IDE. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Nano from the Tools, Board menu (according to the microcontroller on our board). The IC used named as ATmega328 on the Arduino Nano comes pre burned with a boot loader that allows us to upload new code to it without the use of an external hardware programmer.

Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the microcontroller through the ICSP (In Circuit Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:

On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

The Arduino Nano is one of the latest digital microcontroller units and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .in file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.



Figure 4.15: Arduino Software Interface IDE

The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial Communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The

Arduino software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Lab to compile programs, and for uploading the programs it uses argued. As the Arduino platform uses Atmel micro-controllers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuine hardware to upload programs and communicate with them.

Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. ion. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Sketchbook

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog. Beginning with version 1.0, files are saved with a. ion file extension. Previous versions use the. pde extension. You may still open. pde named files in version 1.0 and later, the software will automatically rename the extension to. ino.

Tabs, Multiple Files, and Compilation

Allows you to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

Uploading

Before uploading your sketch, you need to select the correct items from the Tools > Board and Tools > Port menus. The boards are described below. On the Mac, the serial port is probably something like /dev/tty. usbmodem241 (for a Uno or Mega2560 or Leonardo) or /dev/tty.usbserial-1B1 (for a Duemilanove or earlier USB board), or /dev/tty.USA19QW1b1P1.1 (for a serial board connected with a Key span USB-to-Serial adapter). On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, you look for USB serial device in the part section of the Windows Device Manager. On Linux, it should be /dev/ttyACMx , /dev/ttyUSBx or similar. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the Sketch menu. Current Arduino boards will reset automatically and begin the upload. With older boards (pre-Diecimila) that lack auto-reset, you'll need to press the reset button on the board just before starting the upload. On most boards, you'll see the RX and TX LEDs blink as the sketch is uploaded. The Arduino Software (IDE) will display a message when the upload is complete, or show an error. When you upload a sketch, you're using the Arduino Bootloader, a small program that has been loaded on to the microcontroller on your board. It allows you to upload code without using any additional hardware. The Bootloader is active for a few seconds when the board resets; then it starts whichever sketch was most recently uploaded to the microcontroller. The Boot loader will blink the on-board (pin 13) LED when it starts (i.e. when the board resets).

Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch > Import Library menu. This will insert one or more #include statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #include statements from the top of your code. There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch. See these instructions for installing a third-party library.

Third-Party Hardware

Support for third-party hardware can be added to the hardware directory of your sketchbook directory. Platforms installed there may include board definitions (which appear in the board menu), core libraries, Bootloaders, and programmer definitions. To install, create the hardware directory, then unzip the third-party platform into its own sub-directory. (Don't use "Arduino" as the sub-directory name or you'll override the built-in Arduino platform.) To uninstall, simply delete its directory. For details on creating packages for third-party hardware, see the Arduino IDE 1.5 3rd party Hardware specification.

Serial Monitor

This displays serial sent from the Arduino or Genuino board over USB or serial connector. To send data to the board, enter text and click on the "send" button or press enter. Choose the baud rate from the drop-down menu that matches the rate passed to Serial begin in your sketch. Note that on Windows, Mac or Linux the board will reset (it will rerun your sketch) when you connect with the serial monitor.

4.10 Easy IDE

Easy IDE is a web-based IDE tool suite that enables hardware engineers to design, simulate, share - publicly and privately - and discuss schematics, simulations and printed circuit boards. Other features include the creation of a bill of materials, Gerber files and pick and place files and documentary outputs in PDF, PNG and SVG formats. Easy IDE allows the creation and editing of schematic diagrams, SPICE simulation of mixed analogue and digital circuits and the creation and editing of printed circuit board layouts and, optionally, the manufacture of printed circuit boards.

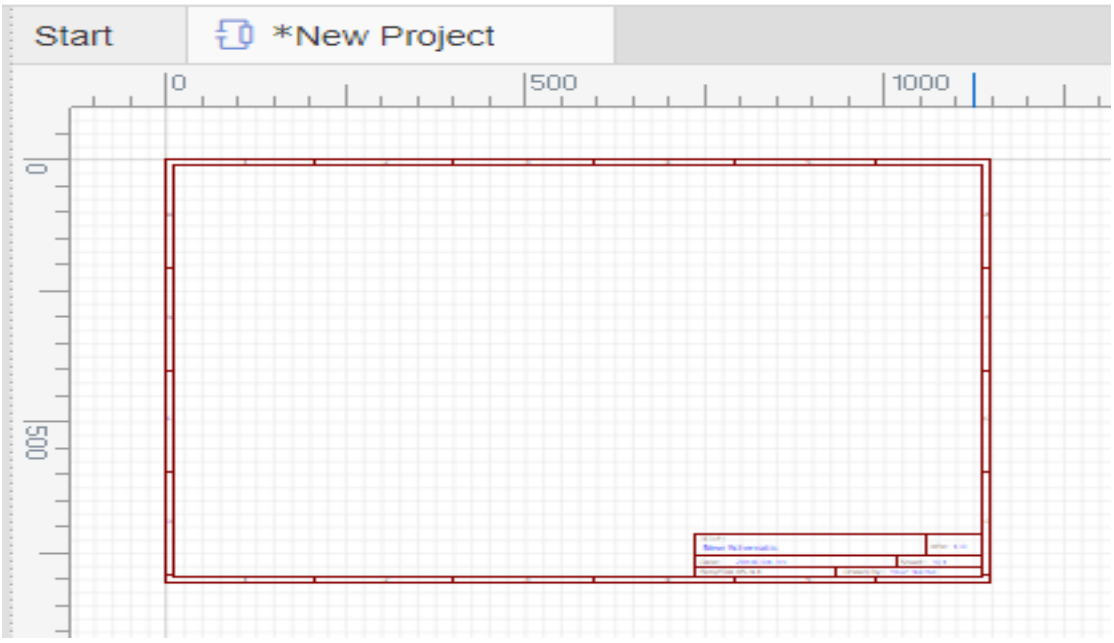


Figure 4.16: Easy IDE Software Interface

Subscription-free membership is offered for public plus a limited number of private projects. The number of private projects can be increased by contributing high quality public projects, schematic symbols, and PCB footprints and/or by paying a monthly subscription. Registered users can download Gerber files from the tool free of charge; but for a fee, Easy IDE offers a PCB fabrication service. This service is also able to accept Gerber file inputs from third party tools.

CHAPTER 5
RESULTS AND DISCUSSION

5.1 Results

After making our project we observe it very careful. It works as we desire. Our project give output perfectly and all equipment are work perfectly. We check how much it works and we get perfect output from this project.

- Finally, we have completed our project successfully & check our project its run accurately according to our objective.

- Table 03: Printing Results

Serial No	Printing Dyes Name	Dyes Size	Use of Color	Print Time
1	SU Logo	Length 12” Width 10”	Blue	45 Seconds
2	Nut Bolt Logo	Length 12” Width 10”	Black	45 Seconds
3	ME Logo	Length 12” Width 10”	Black	45 Seconds

5.1.1 Real View of Printing Surface



S

Figure 5.1: Printing Surface Picture

5.2 Advantages

There are many advantages of our project because of its accuracy. Some of the advantages are pointed out below:

- It’s an automated process.
- Time saving machine for industrial work.
- Reduce energy waste.
- Less skill technicians is sufficient to operate.
- Less time and more profit.
- Ease of operation

5.3 Application

The application areas for this project in this modern and practical world are huge and some of these are given below:

- Industry
- Factory
- Glass Printing
- Packaging
- Textile Printing

5.4 Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features for more efficient.

5.4.1 Cost Analysis

Table 01: Component's Name and Price

Sl. No	Components Name	Specification	Quantity	Unit Price	Total Price
1	SMPS	5V, 7Amp	1	600	600
2	Arduino Nano		1	550	550
3	Gear Motor	12V, 100 RPM	3	600	1800
4	Pulley		6	200	1200
5	Motor Driver	LM298N	2	400	800
6	Buck Converter		1	150	150
6	Others				3500
Total					8600/=

CHAPTER 6
CONCLUSION

6.1 Conclusion

The Screen Printing Machine offers a highly efficient, precise, and cost-effective solution for modern printing needs. By automating the printing and drying processes, it significantly reduces manual labor, operational costs, and production time while maintaining high-quality results. The integration of components such as SMPS, buck converters, and Arduino Nano ensures stable, energy-efficient operation with precise control. This machine is versatile, capable of printing on various substrates such as textiles, plastics, glass, and metals, making it suitable for industries ranging from packaging to electronics. Its eco-friendly design, combined with reduced waste and the ability to support sustainable production practices, enhances its value in today's environmentally-conscious market. Overall, this project offers a forward-thinking solution to improve manufacturing efficiency, support sustainability, and meet the growing demands for high-volume, high-quality printing applications.

6.2 Future Work

We are thinking about adding many features to our project in the future to get more desirable out comes. Some of the steps that we are thinking about taking are given below:

- In future we will add some sensor.
- In future we will add IoT System to operate in fully automatically.
- In future we will add protection equipment to protect this system from any kind of hazard.
- In Future Develop Automating loading and unloading processes for a more streamlined workflow.

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