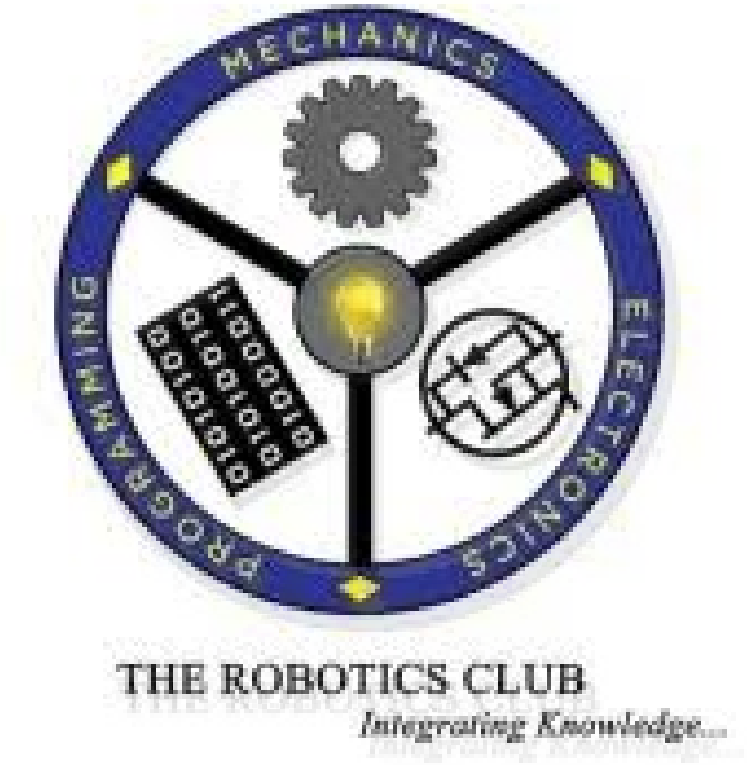
Project Report on

“ROBOTIC GRIPPER”

Submission to **THE ROBOTICS CLUB – SNIST** as a part of **TAB – CAD AND PCB DESIGNING**



THE ROBOTICS CLUB – SNIST

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2024

CERTIFICATE

This is the project work titled '**Robotic Gripper**' by '**Tanmay Sugandhi**' and is a record of the project work carried out during the year 2022 -2023 as part of TAB – CAD AND PCB DESIGNING under the guidance and supervision of

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DECLARATION

The project work reported in the present thesis titled **“ROBOTIC GRIPPER”** is a record of work done by ‘Tanmay Sugandhi’ in **THE ROBOTICS CLUB** as a part of **TAB–CAD AND PCB DESIGNING’24.**

No part of the thesis is copied from books/ journals/ Internet and wherever the portion is taken, the same has been duly referred in the text. The report is based on the project work done entirely by Tanmay Sugandhi and not copied from any other source.

ACKNOWLEDGMENT

This project report is the outcome of the efforts of many people who have driven our passion to explore into implementation of **Robotics Gripper.** We have received great guidance, encouragement and support from them and have learned a lot because of their willingness to share their knowledge and experience.

We thank TAB Chairman **Rakesh Banguru**, Vice-Chairman **Saathvika Revula**, and supervisors **Bhargav, Deekshith** for being with us till the end of the project completion.

We thank all the members of the **Steering Body**, **Executive Body, Technical Advisory Board, and Club's Incubation and Competence Committee** of **The Robotics Club** for helping us with crucial parts of the project. We are deeply indebted to **Mr. N V V S Narayana -** The President, **Ms. M. Shravani -** The Vice President, **Ms. Maliha** - SAB Chairman and **Mr. N Abhinav** - General Secretary **THE ROBOTICS CLUB** respectively and also every other person who spared their valuable time without any hesitation whenever we wanted.

We also thank our faculty advisor **Dr. A. Purushotham**, Professor Mechanical Department, who encouraged us during this project by rendering his help when need

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ABSTRACT
TAB – CAD AND PCB DESIGNING'24

This project involves designing and simulating a robotic gripper arm using Fusion 360, integrating servo and stepper motors for precise control and movement. The gripper, actuated by a servo motor, provides accurate and adjustable gripping force, ensuring secure and delicate handling of objects. The arm segments and base are driven by stepper motors, which enable precise positioning and rotation through discrete steps controlled by a micro-controller.

TITLE OF THE PROJECT: Robotic Gripper with and movable arm.

What inspired you to select the problem?

I have been researching about Gripper for pick and place bot So I decide to see how it would look practically and understand its working

CHAPTER 1:

1.1. PROBLEM STATEMENT:

To design and create a Robotic gripper inside Fusion 360 consisting of servo and stepper motors and test it in simulations using various features features available in Fusion 360.

1.2. INTRODUCTION:

Robotic grippers are essential components in automation and robotics, serving as the "hands" of a robot to manipulate objects in various applications ranging from manufacturing to surgery. Designing an effective robotic gripper involves understanding mechanical design, material properties, and the integration of electronic components like servo and stepper motors. Fusion 360, an advanced CAD tool, provides a comprehensive platform for designing, simulating, and testing robotic components.

CHAPTER 2:

2.1 MATERIALS USED:

Poly-lactic Acid(PLA) Filament, Rubber

2.2. SOFTWARE USED:

Fusion 360

2.3. MATERIALS USED:

2.3.1. Materials used for practical use:

PLA is a material that generally prints better in lower temperatures, in contrast to most other filaments, and is a great candidate for printing with an open build chamber. In some cases, operators printing PLA on printers with enclosed chambers may find benefit in allowing heat to escape from the chamber. A controlled-chamber is preferred for best success. PLA generally exhibits low thermal shrinkage, as well.

Fig 2.1 PLA

2.3.2. The material used in Fusion 360:

Plastics are a wide range of synthetic or semi-synthetic materials that use polymers as a main ingredient. Their plasticity makes it possible for plastics to be molded, extruded, or pressed into solid objects of various shapes. This adaptability, plus a wide range of other properties such as being lightweight, durable, flexible, and inexpensive to produce, has led to their widespread use.Plastics are typically made through human industrial systems. Most modern plastics are derived from fossil fuel-based chemicals like natural gas or petroleum; however, recent industrial methods use variants made from renewable materials, such as corn or cotton derivatives.

2.4.SOFTWARE DESCRIPTION:

Fusion 360 is a 3D CAD program by Autodesk. Its name comes from the software's ability to allow users to go through much of the design pipeline without ever needing to switch programs. It was first launched in 2013 and became an almost instant hit. Fusion 360 has only grown in popularity since. Its popularity derives from the accessible price, flexible

options, and versatile applications. The program can be used for 3D modelling, generative design, failure mode simulation, electrical circuits, manufacturing, and motion animation.

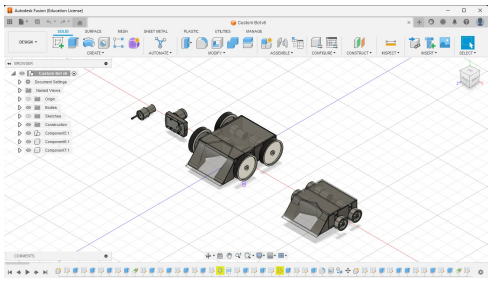

Fig 2.1 CAD Example

CHAPTER 3:

3.1. 3-D MODEL:

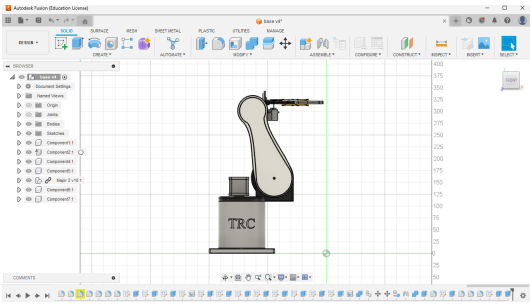

Fig 3.1. Side View

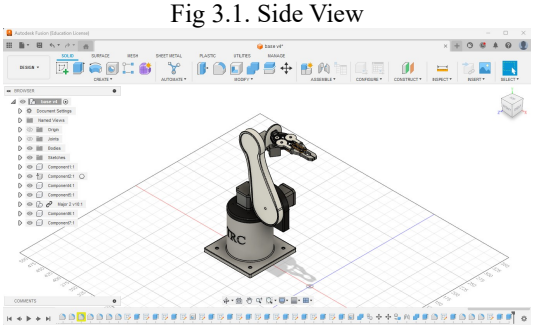

Fig 3.2. View 1

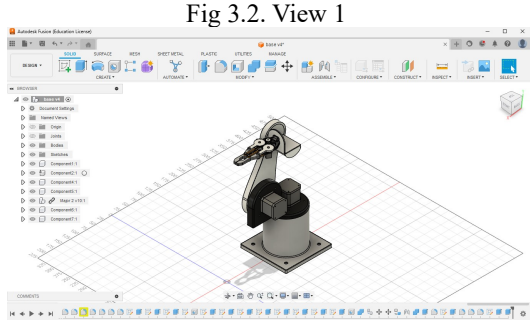

Fig 3.3 View 2

3.2. WORKING:

The robotic gripper arm operates through a combination of servo and stepper motors to achieve precise movement and control. The gripper mechanism, driven by a servo motor, provides accurate control over the opening and closing actions of the gripper fingers. This allows the gripper to apply just the right amount of force to securely grasp objects without causing damage. The arm segments and base rotation are managed by stepper motors, which rotate in discrete steps for precise positioning.

CHAPTER 4:

4.1 ANALYSIS:

4.1.1. STATIC STRESS:

When designing mechanical objects, you often want them to be just adequately sturdy. Make the objects too wimpy, and they will break. Make the objects too sturdy, and they will be larger, heavier, and/or more expensive than they need to be. By simulating static stress, you can strip down unnecessary parts and reinforce weak points before sending your part to production, making your part strong where you need it to be and, at the same time, smaller, lighter, and cheaper. The material stress limits are represented as the material yield strength or ultimate tensile strength. Safety factors are expressed as the ratio of the maximum strength of the material (Yield or Ultimate Tensile Strength) to the

actual stress in part (Von Mises or 1st Principal Stress):

Safety Factor = Material Strength / Actual Stress

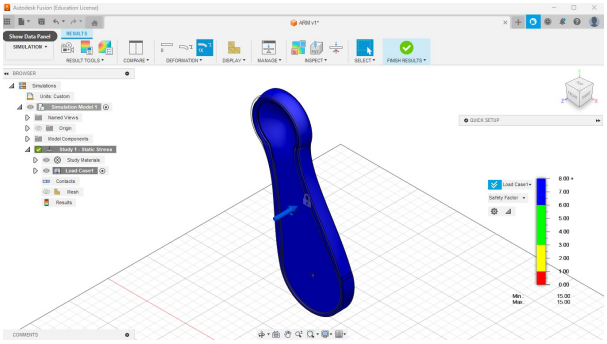

Fig 4.1 Arm Safety

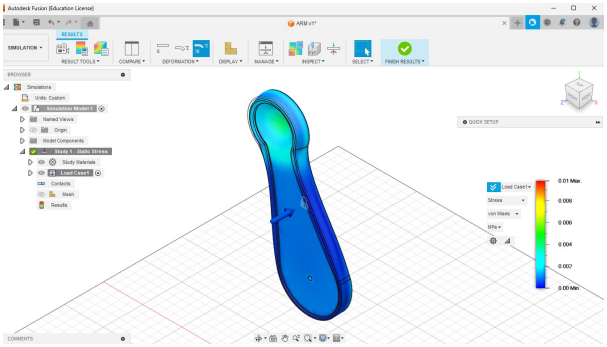

Fig 4.2 Arm Stress

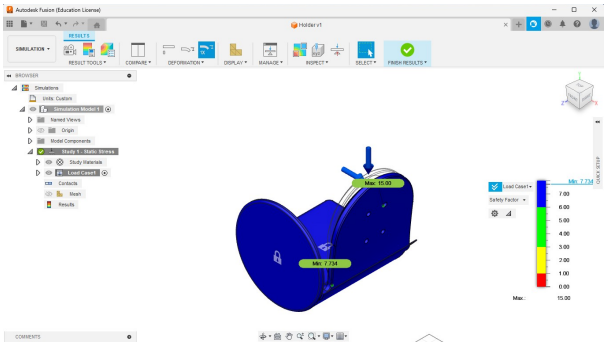

Fig 4.3 Holder Safety

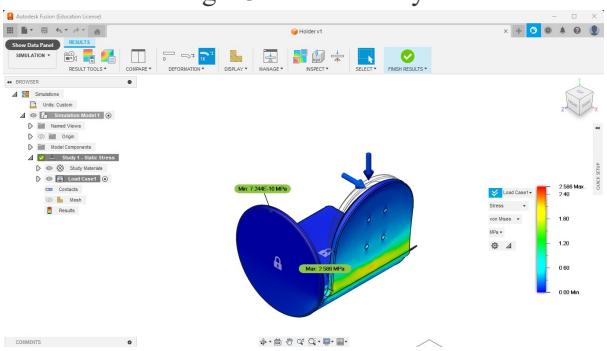

Fig 4.4 Holder Stress

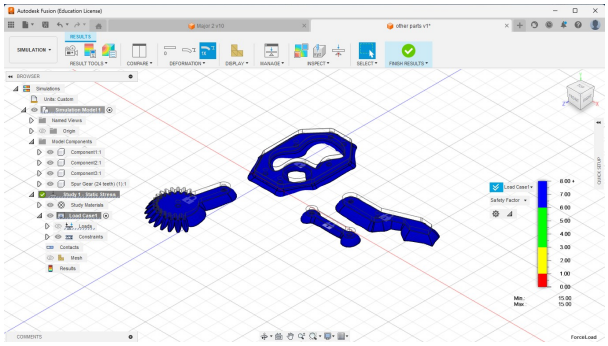

Fig 4.5 Gripper Safety

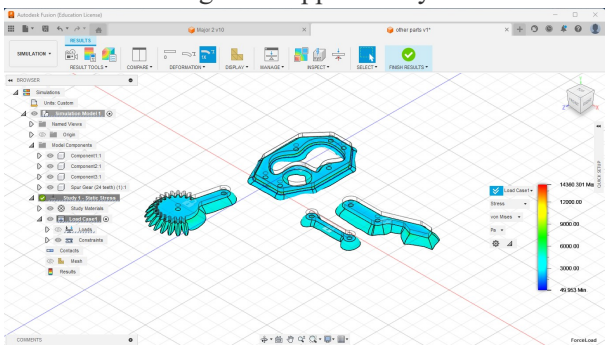

Fig 4.6 Gripper Stress

CHAPTER 5:

5.1. RESULTS:

The cad model of the robotic gripper arm is perfect and has all perfect rotation and rigid joints.

5.2 FUTURE ENHANCEMENTS:

Making the model use less material and adding more Degree of freedom. And making the material more durable i.e use aluminum or fiber glass for gripper instead of plastic.

5.3. CONCLUSION:

The overall conclusion of this project is that a CAD model of the Robotic Gripper Arm is successfully designed.