LAB REPORT on

MIRROR ADJUSTMENT DEVICE

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OBJECTIVE:

The mirror adjustment device must fulfil following properties:

• the MAD is to be placed according to the sketch below

• mirror dimensions: 42mmx34mmx4mm

• the mirror must be realized the reflection of a parallel optical path (aperture Ø17mm)

• DOF mirror: 45°tilt +/- 10° with precision of 6’

• After setting of mirrors, the DOFs are to be fixed.

• The MAD is to be mounted to the frame of an instrument.

(The connection between MAD and the frame can be designed individually)

• production volume: 5…10 MAD

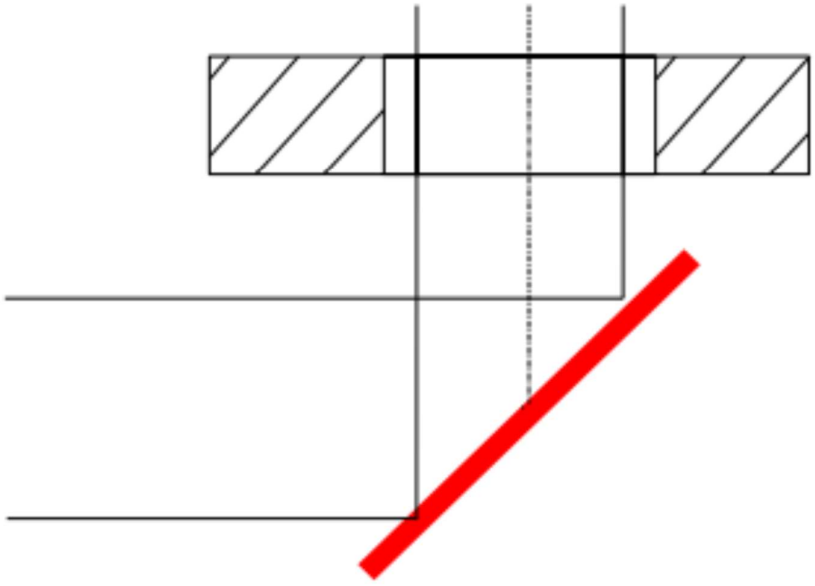

Figure 1: Objective View of the Device

REQUIREMENTS:

1. Nut
2. Adjustment Screw
3. Mirror Holder
4. Mirror
5. Tension Spring
6. Device Holder

FUNCTIONAL DESCRIPTION:

The mirror is positioned at a 45-degree angle relative to the device holder's base within its holder, which securely holds it in place using a nut and adjustment screw located underneath. The container housing the mirror is aligned with the adjustment screw, allowing it to spin freely without any constraints. By rotating the adjustment screw, the mirror can be moved forward.

When light strikes the mirror, it reflects and passes through the instrument plate via an optical channel or aperture positioned above it. A specific screw and nut are meticulously designed to fit together seamlessly. The screw is inserted into a fixed nut, firmly placed within the raised section of the MAD, utilizing mate constraints. Constraints are strategically positioned to enable the screw to pass through the base and contact the back of the mirror-holding frame, with the initial rotational axis set at 45 degrees.

To adjust the mirror's position, one must advance the adjustment screw and rotate the mirror holder clockwise. A tension spring integrated into the mirror holder ensures the mirror remains securely in place and returns to its original position when not in use. Potential future advancements could involve increasing the MAD's rotational degree by utilizing a relative screw in conjunction with an appropriate adjustment screw model.

In comparison to alternative methods, the combination of the tension spring and adjustment screw is preferred due to its simplicity and minimal design requirements. Compatible adjustment screws and nuts are readily available, making customization cost-effective. Furthermore, this system experiences minimal stress and occupies less space, resulting in an extended lifespan. All components of the equipment are constructed from stainless steel for durability and longevity.

DESCRIPTION OF PARTS:

1. NUT:

The Nut is placed on the Mirror Adjustment Device behind the Mirror Holder. This is fixed using constraints and placed on the back of Mirror Holder. The Adjustment screw goes into the Nut which creates change in angle for the Mirror Holder.

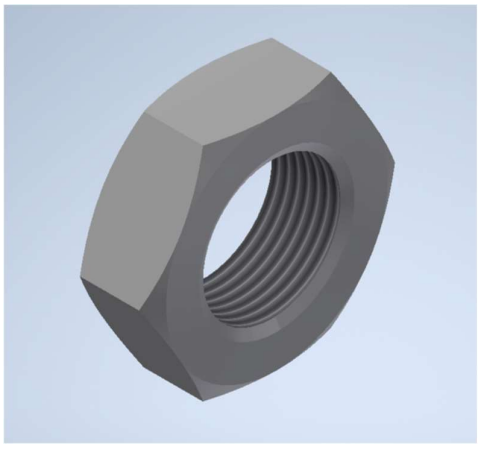

Figure 2: Nut_3_8_40_THD

2. ADJUSTMENT SCREW:

A screw utilized to manipulate the movable parts of a device or mechanism into desired positions, often ensuring their secure alignment. In this case, it is specifically used for precise adjustment of the mirror's angle. By turning the screw, the mirror can be angled within a range of +/- 10° from its resting position at 45°. However, this functionality is not applicable in the current model.

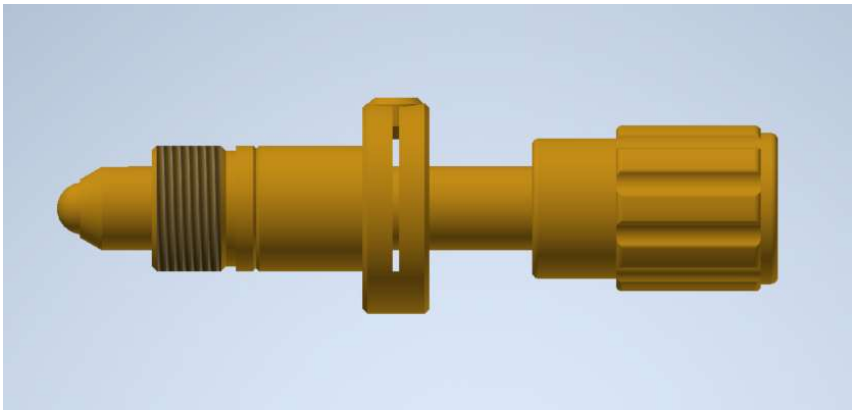

Figure 3: Adjustment Screw (Treat-3/8 40 THD and simplified as part)

3. MIRROR HOLDER:

In the middle of the rectangular box holding the mirror, there's a rectangular hollow space. The purpose of the cylindrical extrusions on either side is to support the mirror holder in the air. With a spring and a screw, the mirror is put in the rectangular hole below the path where light goes, tilted at an angle.

The light beams are reflected at a 90-degree angle upon contact with the mirror, and they go through the optical channel and the instrument plate hole. As seen in the above illustration, a circular ring positioned in a corner helps secure the tension string to the mirror holder. Near the round ring, the adjustment screw meets a dome extrusion. The entire device-holder-like structure is composed of stainless steel.

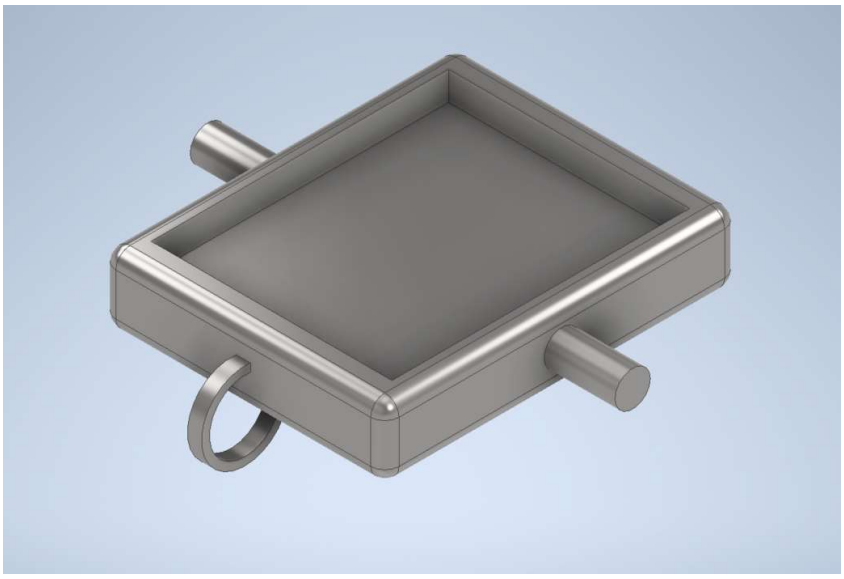

Figure 4: Mirror Holder

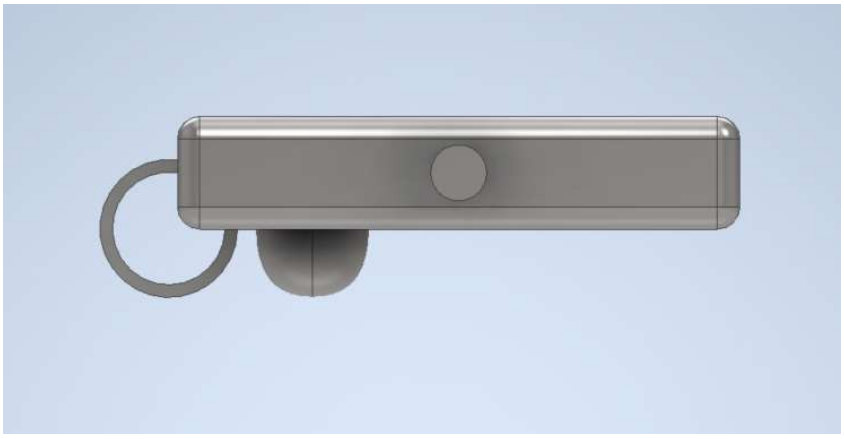

Figure 5: Mirror Holder (Side View)

4. MIRROR:

The mirror is 45° angled and fastened to the mirror holder. It is an object that reflects light so that most or all the original light's unique physical attributes are retained in the reflected light for incident light falling within a certain range of wavelengths. We call this phenomena reflection.

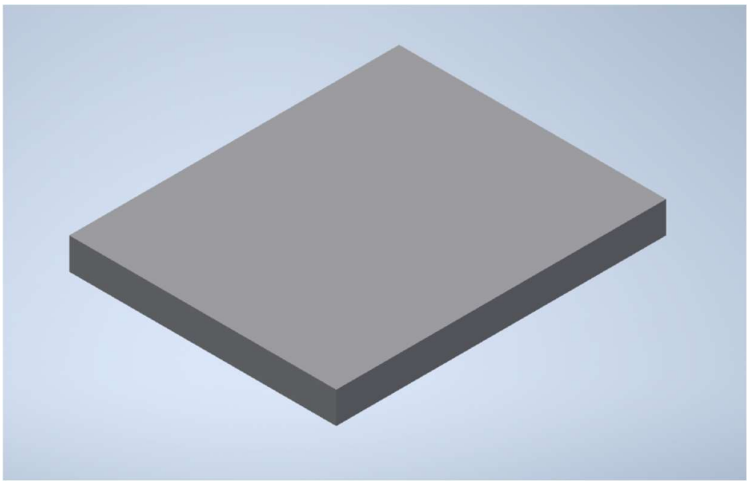

Figure 6: Mirror.

5. TENSION SPRING:

This is placed between the device holder and the mirror holder is the tension spring. Springs are elastic materials that can store mechanical energy. Springs are usually constructed from spring steel. Springtime patterns come in many forms. In everyday speech, coil springs are usually mentioned.

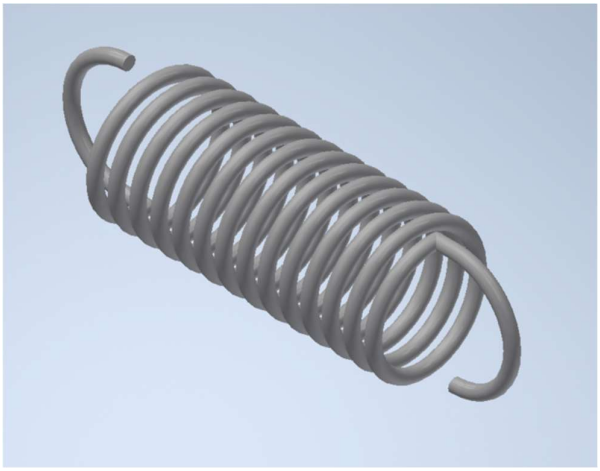

Figure 7: Tension Spring

6. DEVICE HOLDER:

The device holder consists of a head and a base. Light can pass through the optical channel in the head, which looks like a round hole. The instrument plate sits above the head, aligned so that its holes match those in the head. The head and base are connected diagonally.

On these diagonal pillars, there are two straight holes opposite each other. These holes hold the extension of the mirror holder. A semicircular ring beneath the mirror holder keeps the tension spring in place. Additionally, the device holder has a raised platform with axes aligned by a nut and adjustment screw combination. The adjustment screw moves freely through a hole in the centre of the raised platform. Stainless steel is used for the device holder because it resists corrosion better than other common materials.

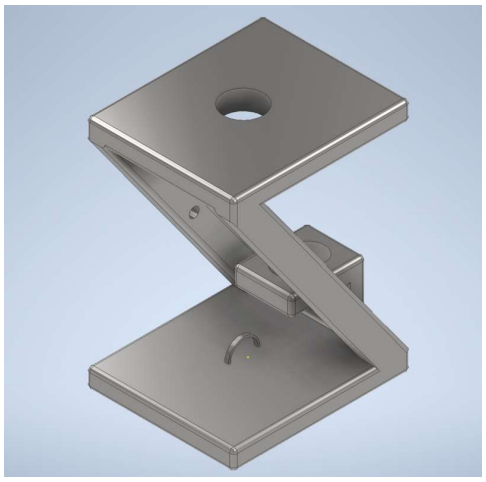

Figure 8: Device Holder

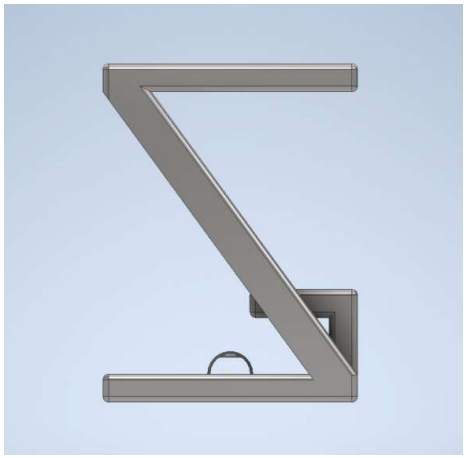

Figure 9: Device Holder (Side View)

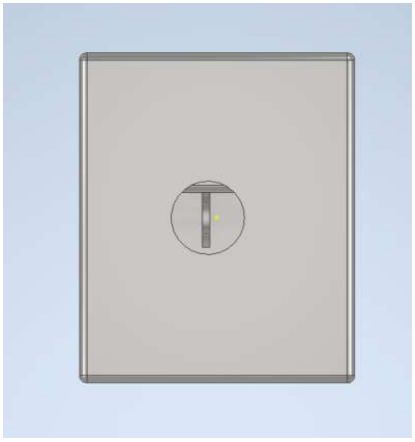

Figure 10: Device Holder (Top View)

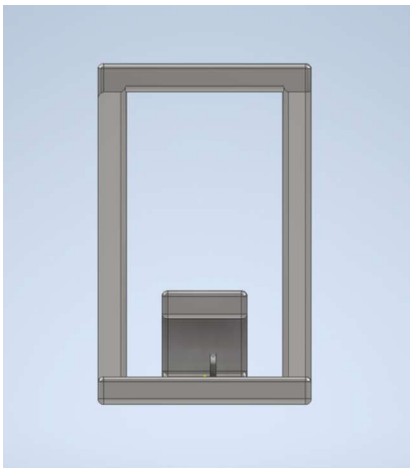

Figure 11: Device Holder (Front View)

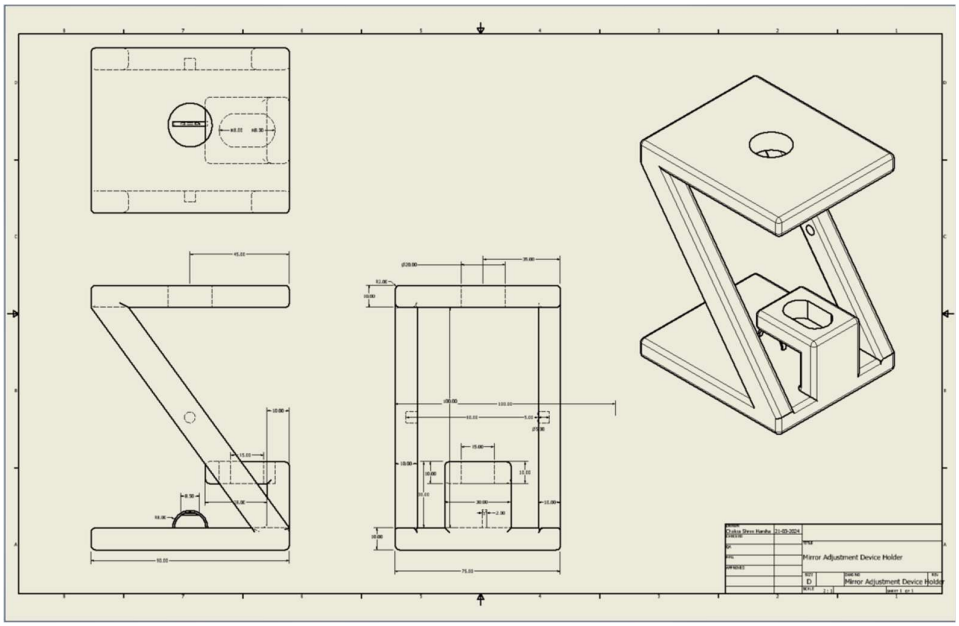

Figure 12: Assembly Drawing of Device Holder

MATERIAL SELECTION:

- Stainless steel is an affordable, durable metal with a wide range of applications. Its durability makes it perfect for use in construction, and its resistance to corrosion means that it won't break or need to be replaced for a very long time.
- Because stainless steel is readily available, simple to use, and reasonably priced when compared to other alloys, both the device holder and the mirror holder in the mirror adjustment device are constructed of this material.

FINAL ASSEMBLY:

The assembling of the various parts is depicted in the below diagram. The device holder's head is positioned above the instrument plate. Constraints on the centre device holder aid to fit the mirror holder in place. The mirror is positioned inside the holder. It is 45° angled in relation to the device holder's base.

Any light beams that strike the mirror are deflected by 90 degrees via the instrument plate's hole and the optical path. The mirror may be tilted +/-10° with the assistance of an adjustment screw and nut, and its position can be maintained with the help of a spring. Every time the mirror holder is moved, the spring helps it return to its original position. The spring is inserted between the device holder's and the mirror holder's circular rings. All the parts are constructed of stainless steel, and the screw and nut are raised to a height where they can contact the extruded dome in the mirror holder.

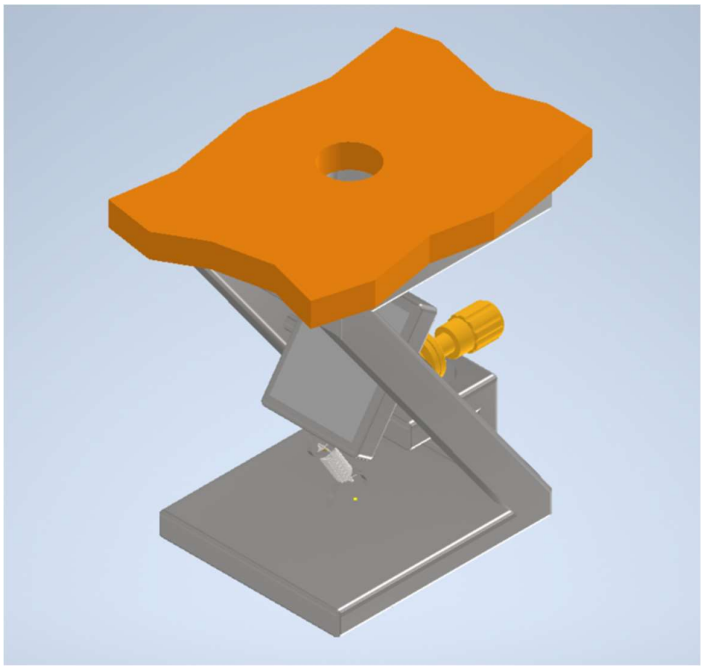

Figure 13: Mirror Adjustment Device

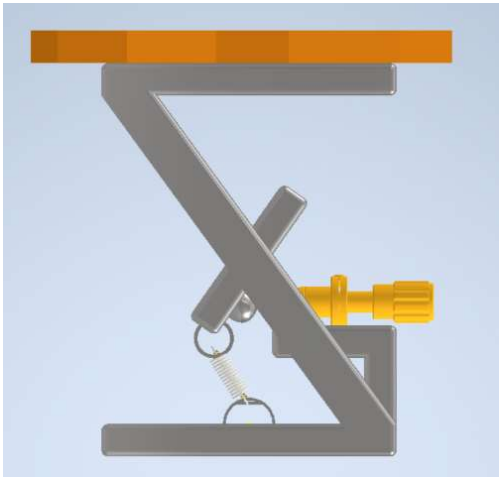

Figure 14: Mirror Adjustment Device (Side View)

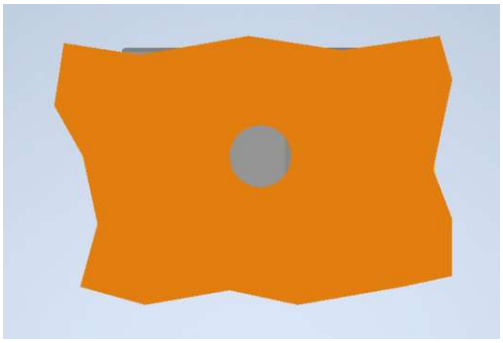

Figure 15: Mirror Adjustment Device (Top View)

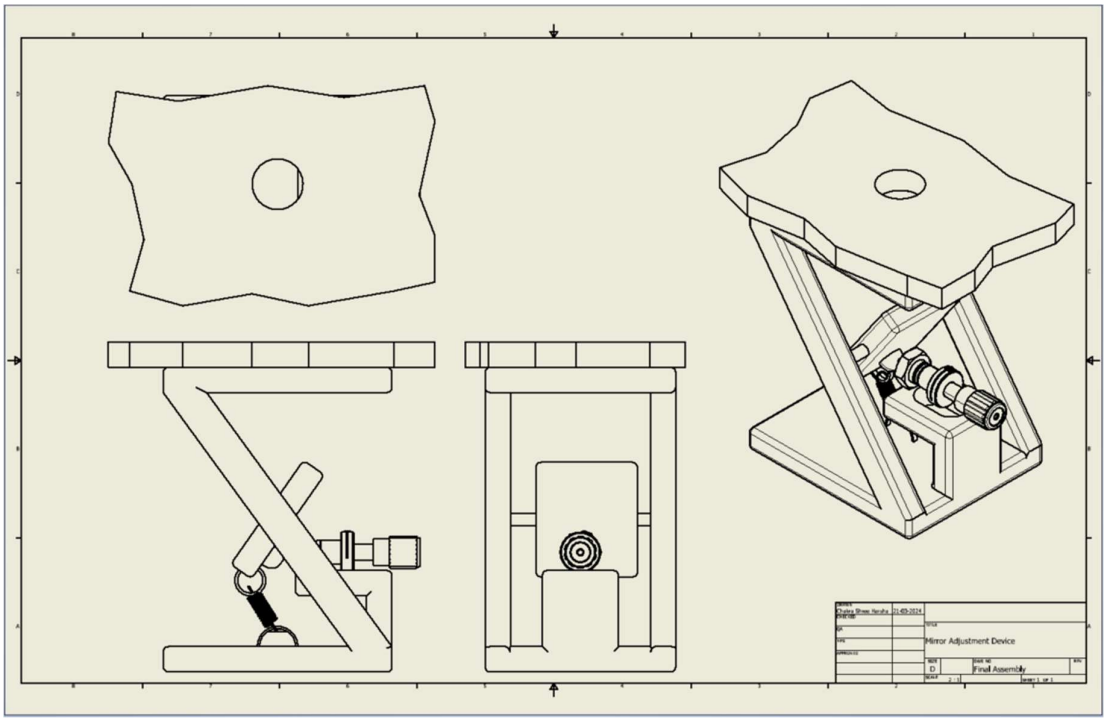

Figure 16: Assembly Diagram of Mirror Adjustment Device

CONCLUSION:

1. The mirror's dimensions are 42 x 34 x 4 mm, and the aperture diameter of the parallel optical path is 18 mm.
2. It has a tilt of +/-10° and a precision of 6'.
3. The mirror is fixed to the mirror frame.
4. The design is practical and affordable, making it possible to manufacture 5 to 10 MAD.

Declaration of Independence:

I hereby declare that the Report submitted is my own unaided work.

Date of Submission: 21-03-2024

Chakra Shree Harsha Aravilli Venkata, 21-03-2024, Jena.