



FINAL REPORT

GROUP 20

Team: Eklavya



OUR TEAM

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NEED STATEMENT

TO DESIGN A PORTABLE HURDLE INCORPORATING SAFETY FEATURES TO AID ATHLETES IN LEARNING HURDLE CLEARANCE TECHNIQUES

USER GROUP	Amateur athletes (And hurdle race enthusiasts who fear tripping) Age group: 8 to 40
ENVIRONMENT	Outdoor race track

DESIGN OPPORTUNITIES

PORTABILITY

The hurdles in our surroundings are not very portable. However, we have designed hurdles that are portable and easy to store in compact spaces.

SAFETY

Hurdles are often susceptible to causing trips, which can result in injuries and disrupt an athlete's momentum. Our design aims to help athletes maintain a constant momentum while clearing the hurdle bar, thereby minimizing the risk of tripping and avoiding injuries.

HEIGHT ADJUSTABILITY

Available Hurdles have adjustable heights, but changing the height is difficult. Our design allows athletes to easily adjust the height.

MOCK-UP 1

PORTABILITY

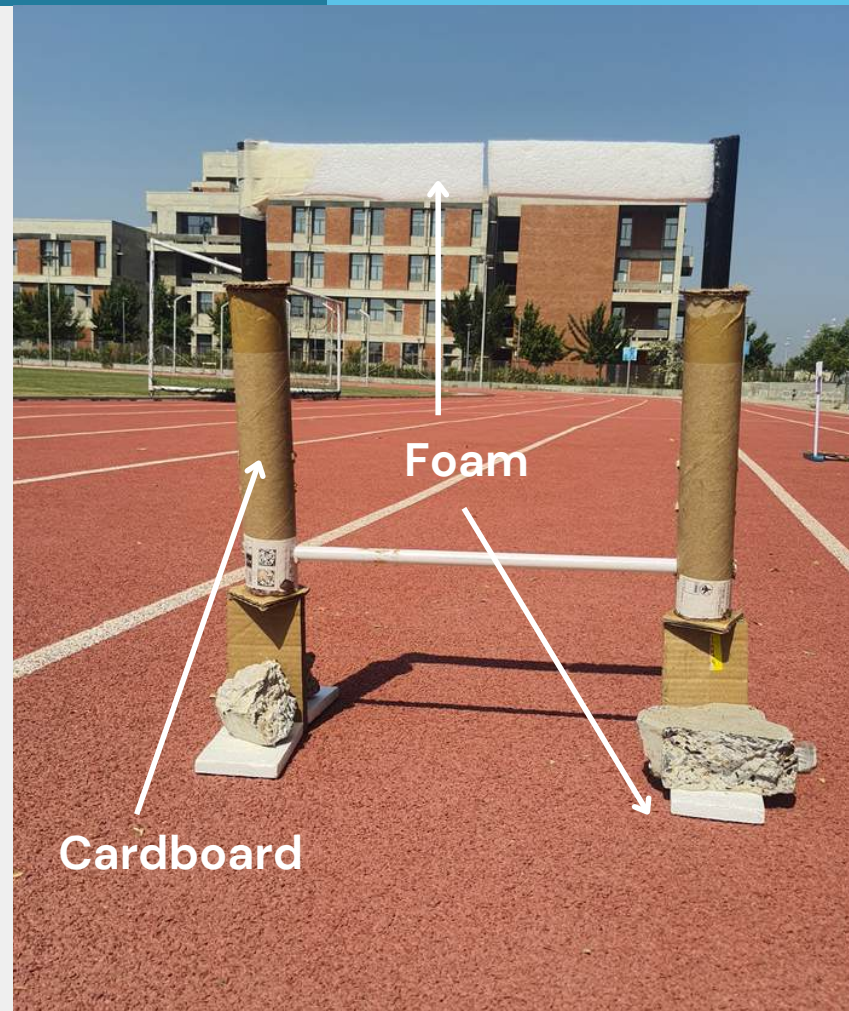
This mock-up features a removable rod combined with the elastic flap (eg: rubber). The hurdle's base stand has a hinged mechanism which opens and closes.

SAFETY

The elastic flap (eg: rubber) used will have retractable properties, meaning it will open slightly when the athlete's leg touches it and return to its normal position when the leg leaves.

HEIGHT ADJUSTABILITY

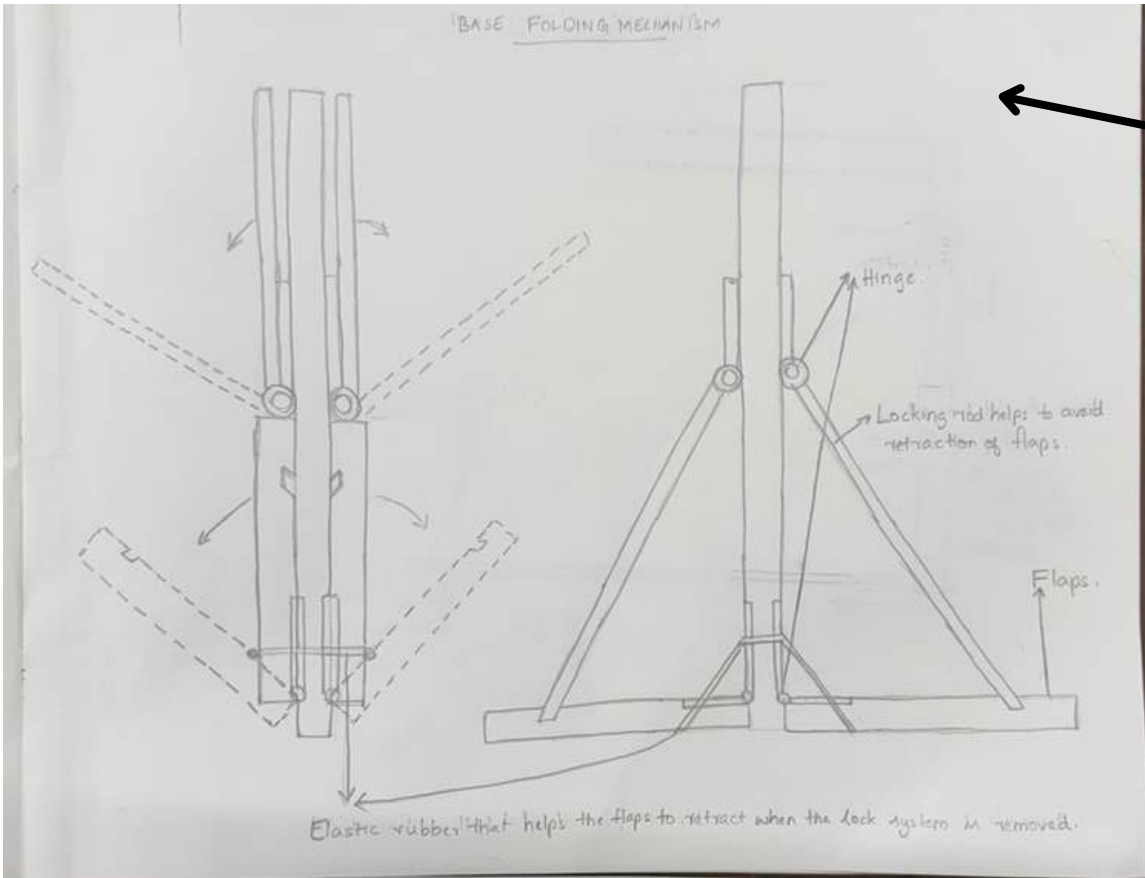
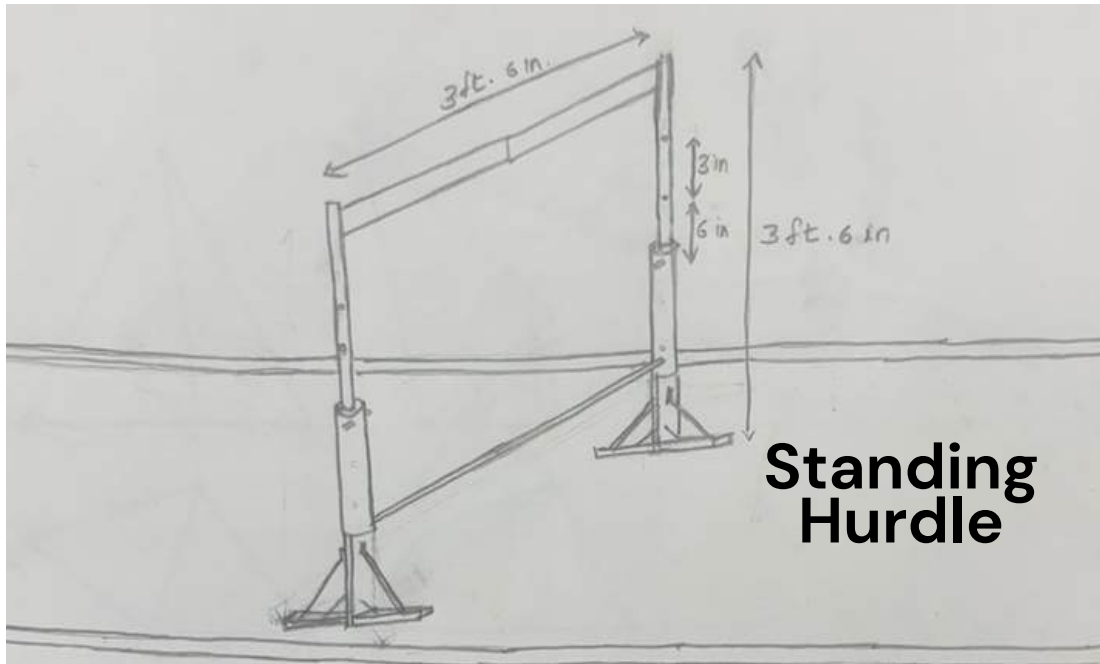
The upper metal rod can slide into the base pipe and be locked at specific heights.



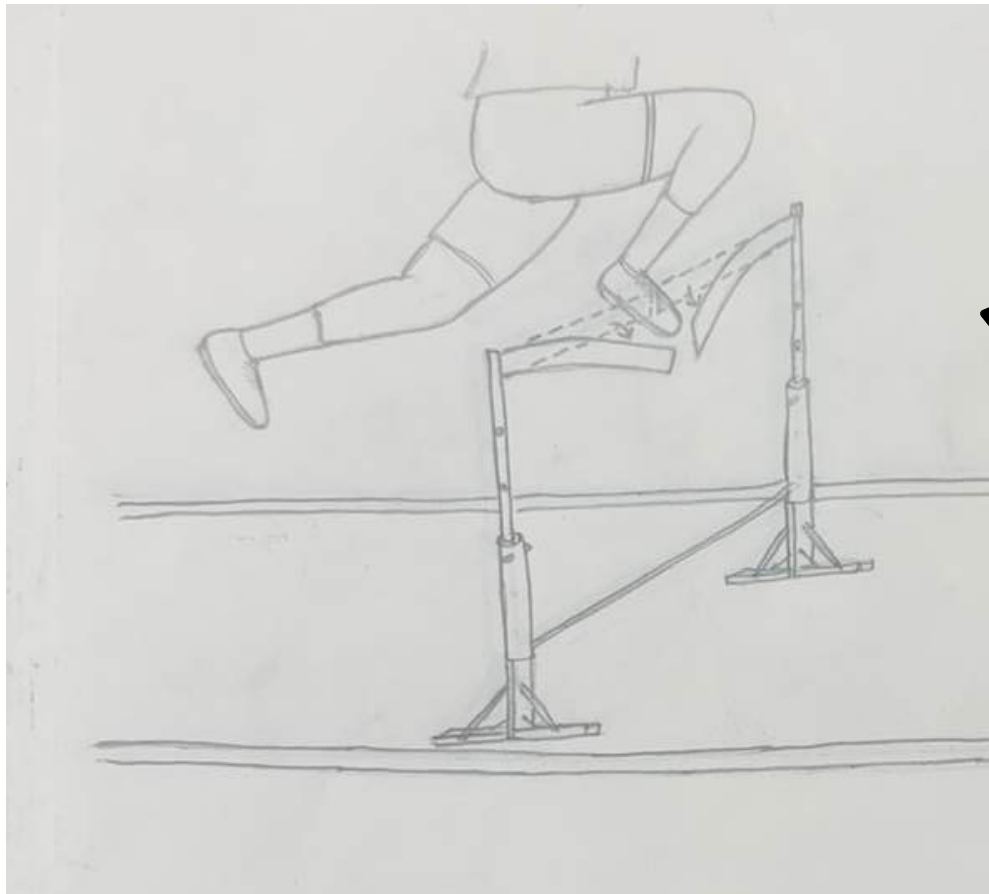
PHOTOS FROM
ACTUAL
ENVIRONMENT



MOCK-UP 1: SKETCHES

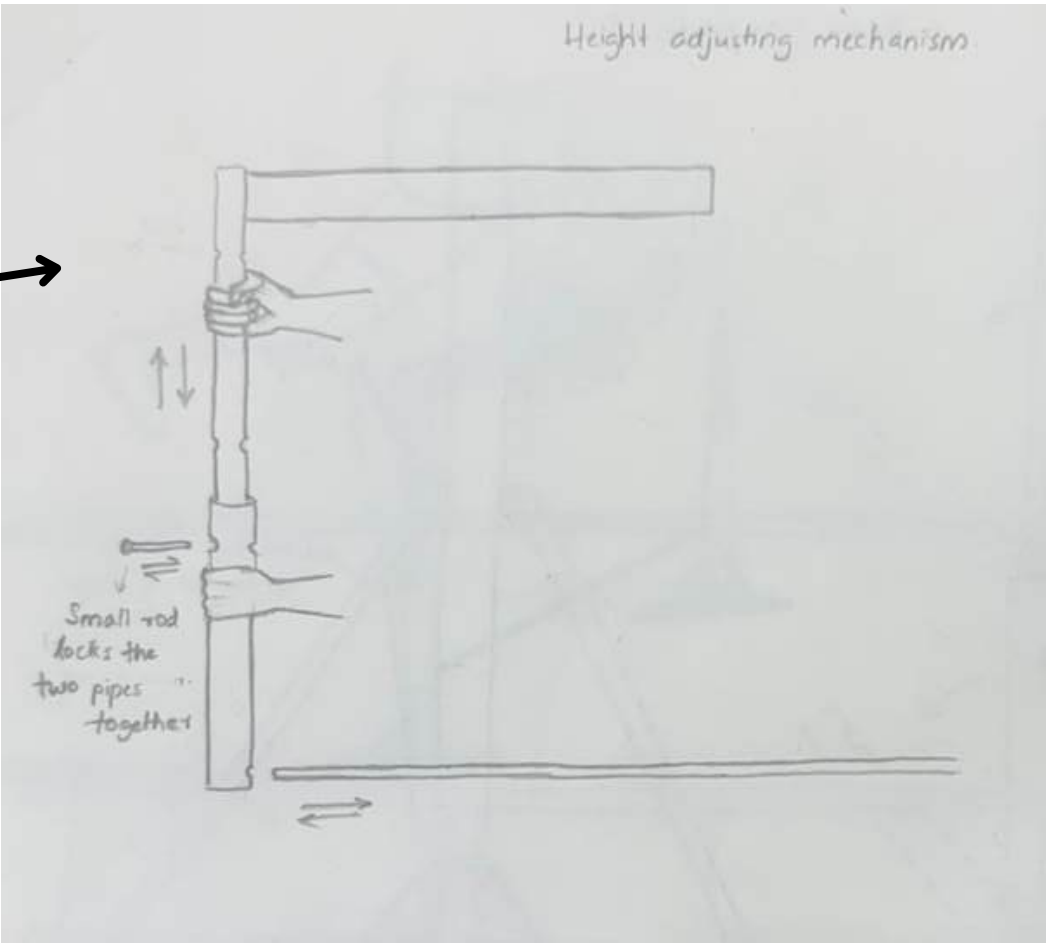


To increase portability, designed a hinge mechanism base



Elastic flap is retractable which retains its position when leg leaves

The upper rod slides in pipe, to adjust height with locking system



MOCK-UP 2

PORTABILITY

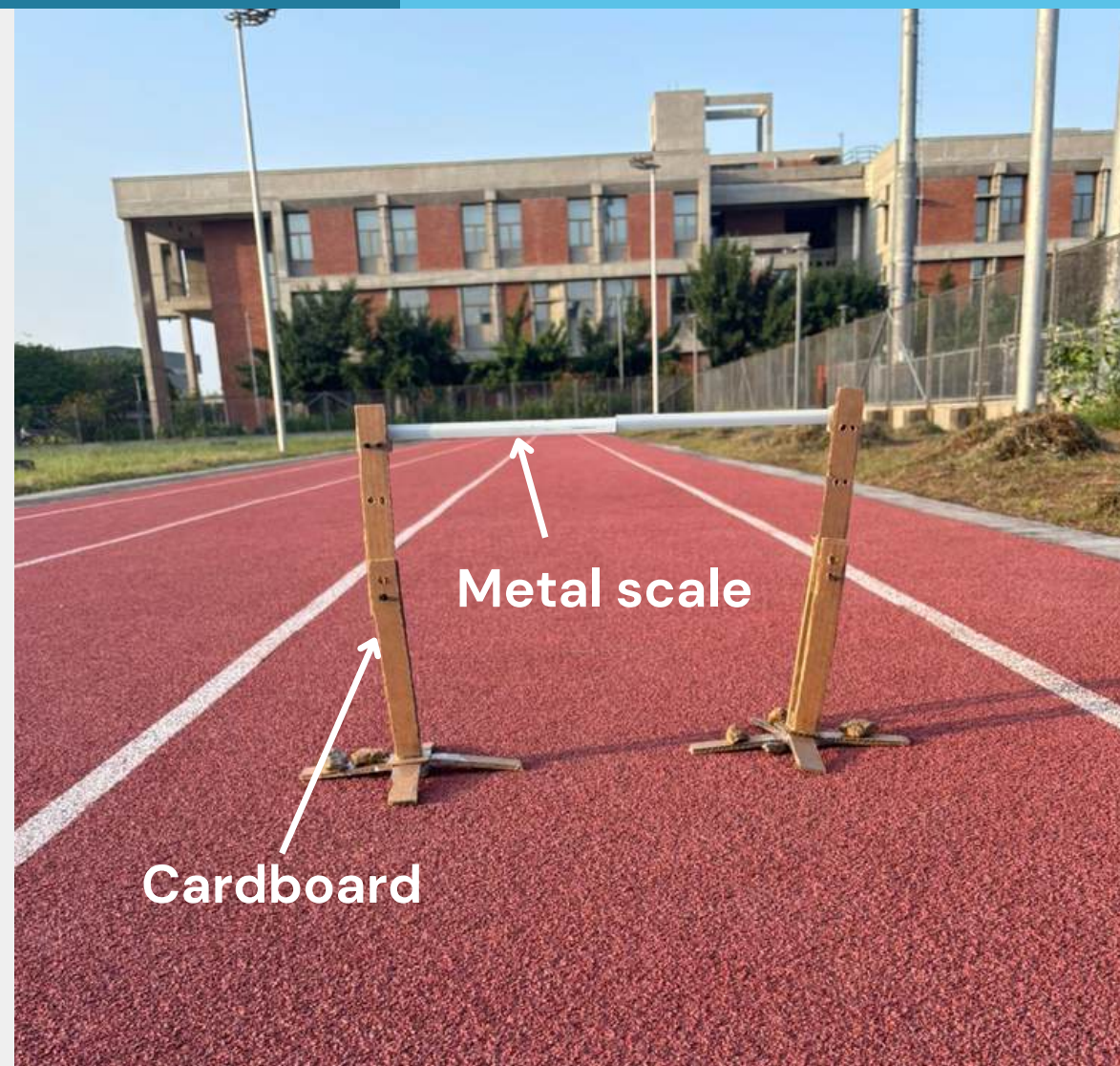
This mock-up features a removable rollable scale bar. The upper shafts can rotate to fit into the space between both base bars. It includes a foldable base.

SAFETY

The rollable scale bar is designed so that when an athlete's leg touches it, the scales roll outward. This prevents the athlete from getting stuck in the hurdle and reduces the risk of injury.

HEIGHT ADJUSTIBILITY

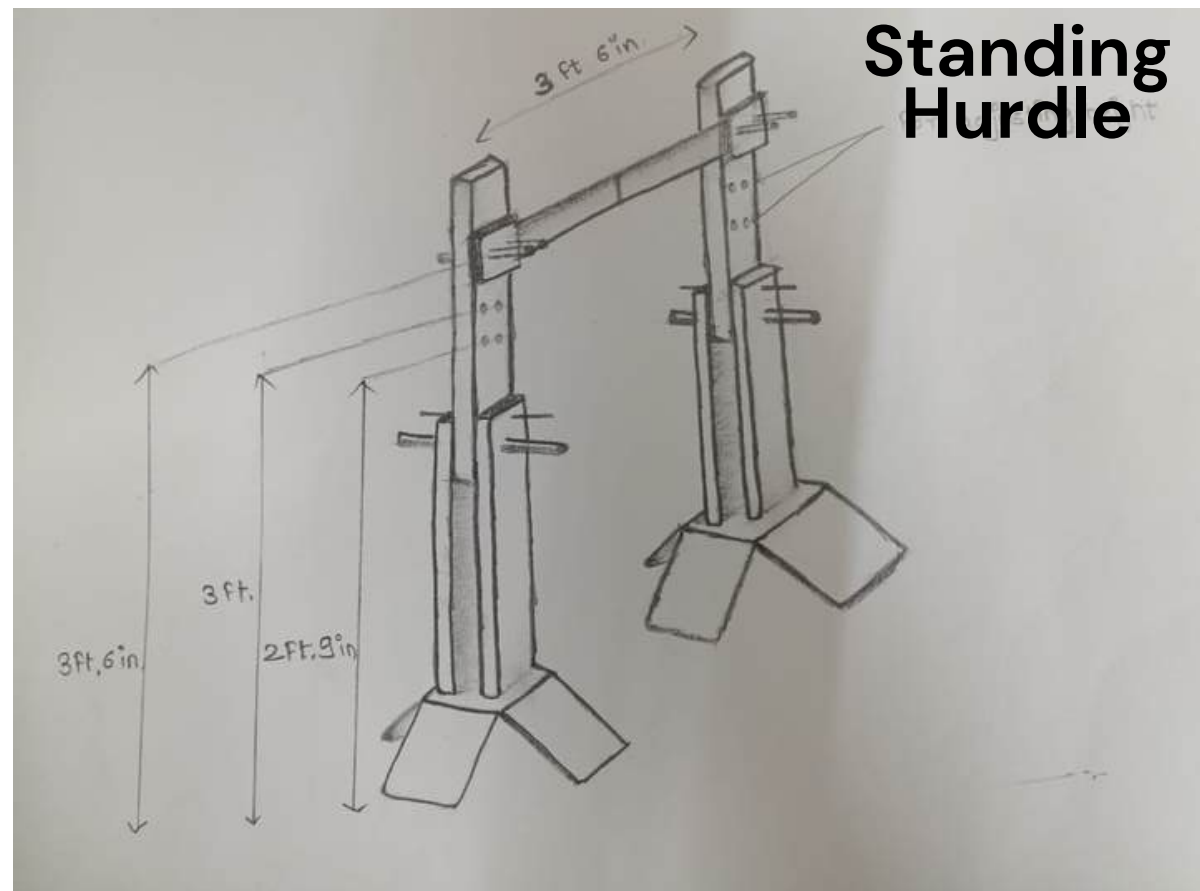
The rollable scale bar can be adjusted to specific heights, where it locks into place in the holes.



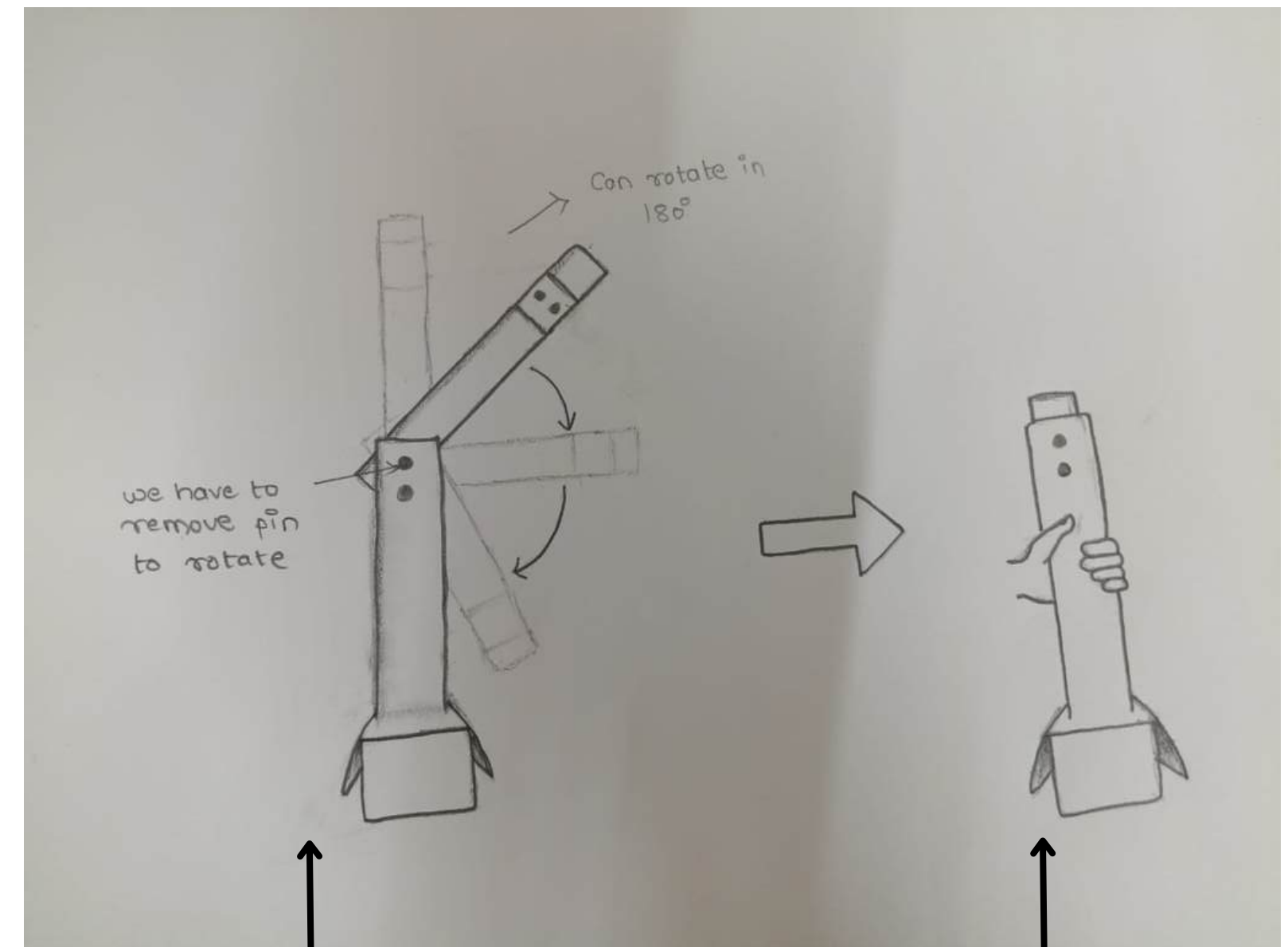
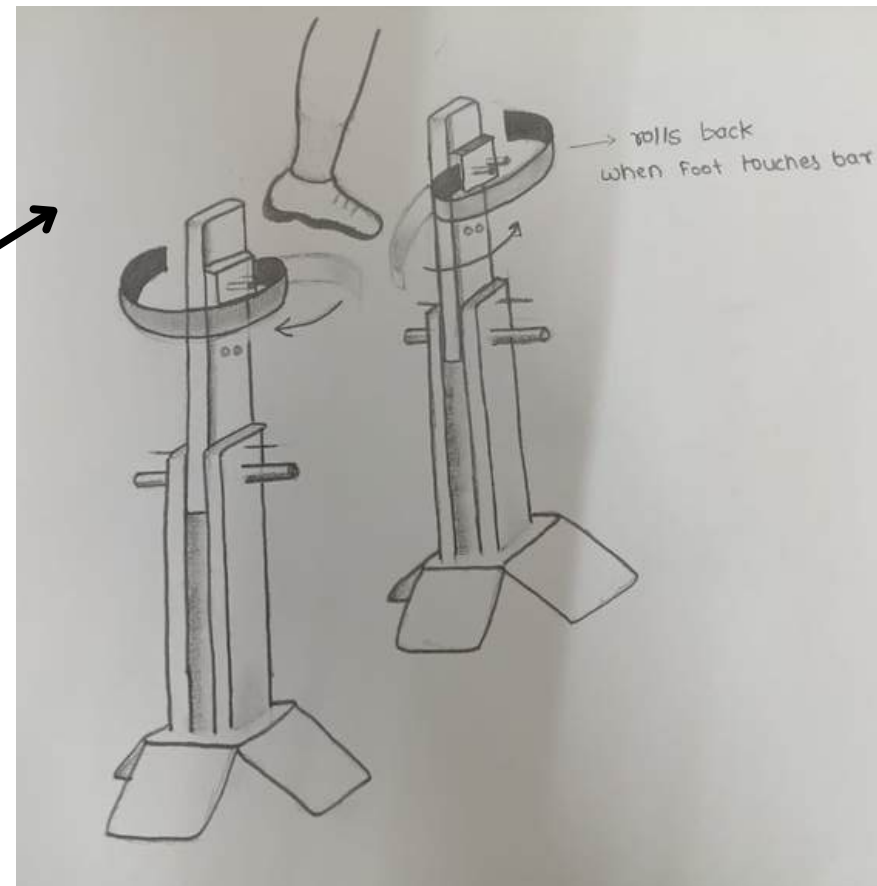
PHOTOS FROM
ACTUAL
ENVIRONMENT



MOCK-UP 2: SKETCHES



Scale
rolls
outward



Shaft rotates to
place in the space
between both base
bars

It can be hold in
hand
(Portable)

MOCK-UP 3

PORTABILITY

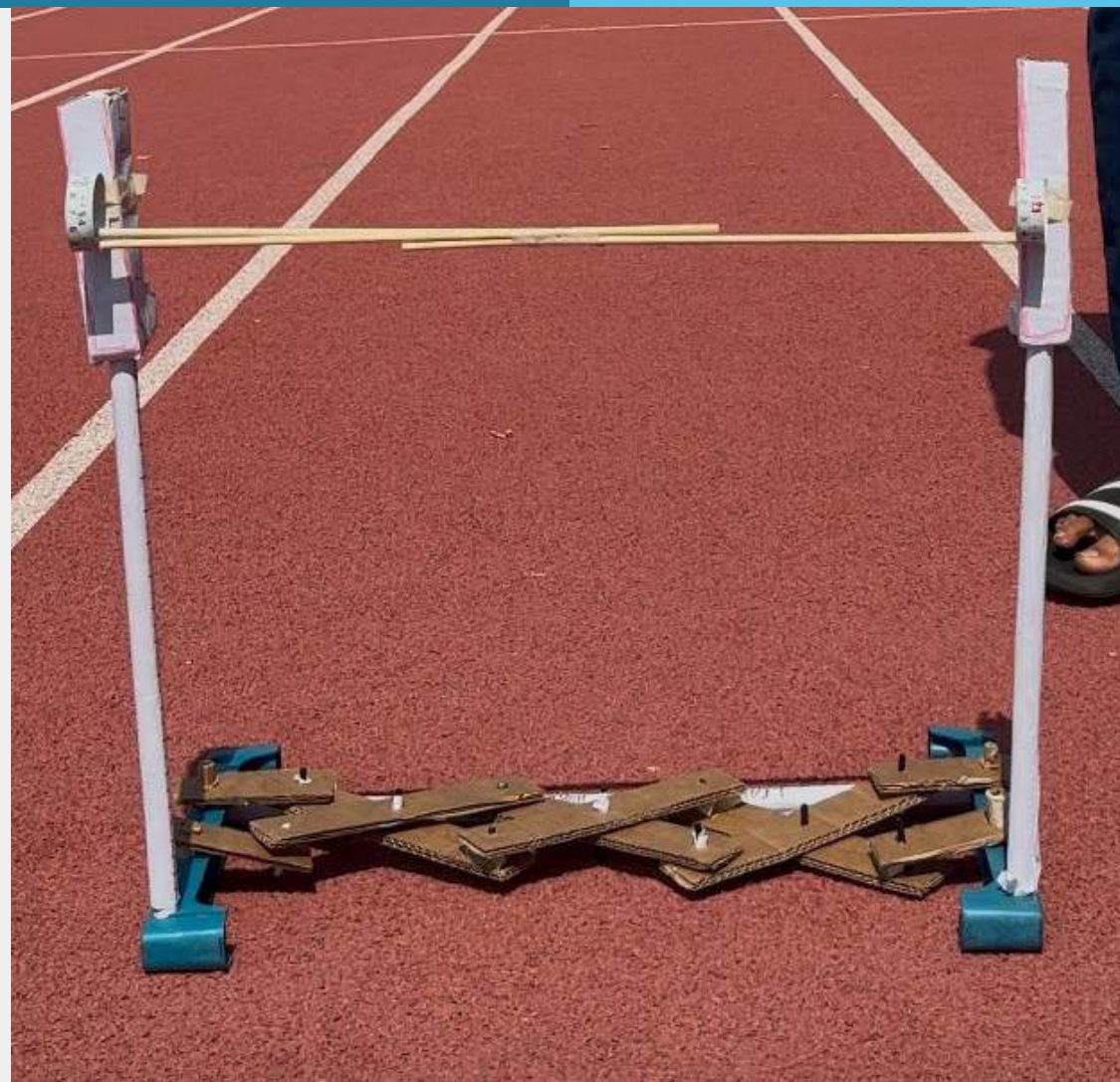
The working of base is based on pivot - scissor mechanism. We can fold it easily in a compact form.

SAFETY

The rod is connected to the side bar of hurdle with the help of a magnet. When the athlete's leg touches the rod, it detaches the rod from the hollow hole of magnet strip, preventing injury.

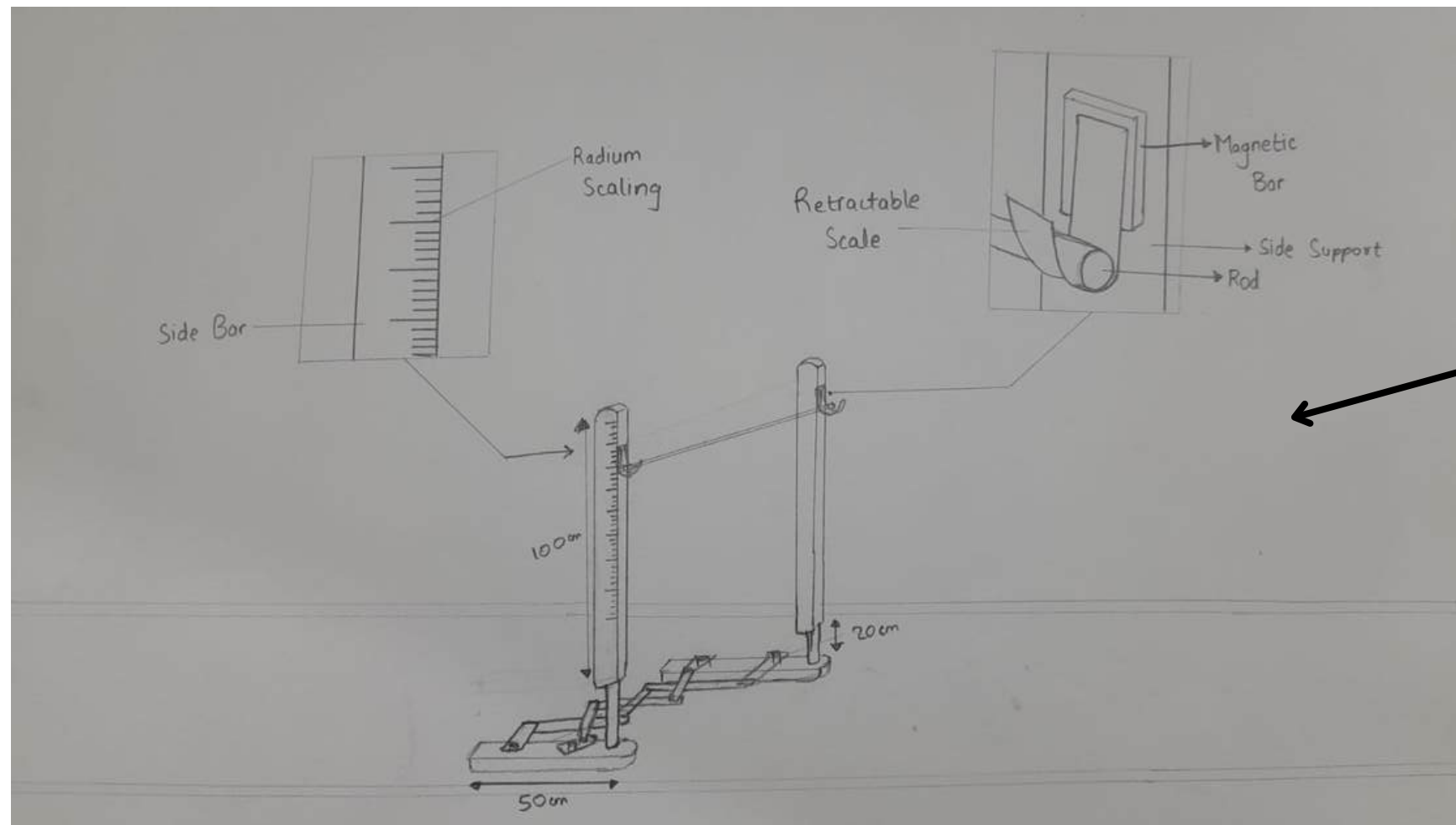
HEIGHT ADJUSTABILITY

The rod features a retractable scale attached to a magnet (A). Magnets (B) are located at specific heights on the sidebars. Magnet A and B will be in contact.



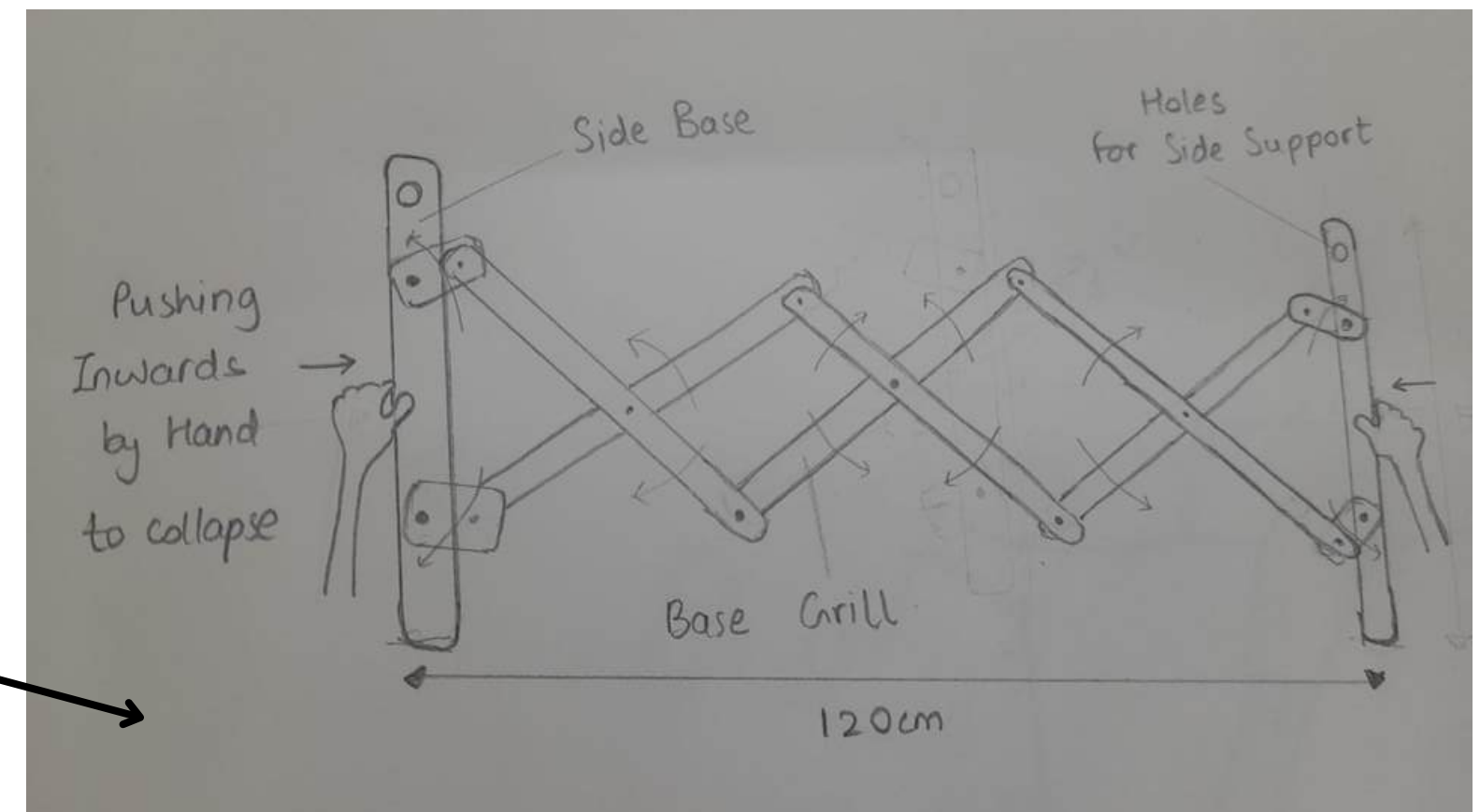
PHOTOS FROM ACTUAL ENVIRONMENT

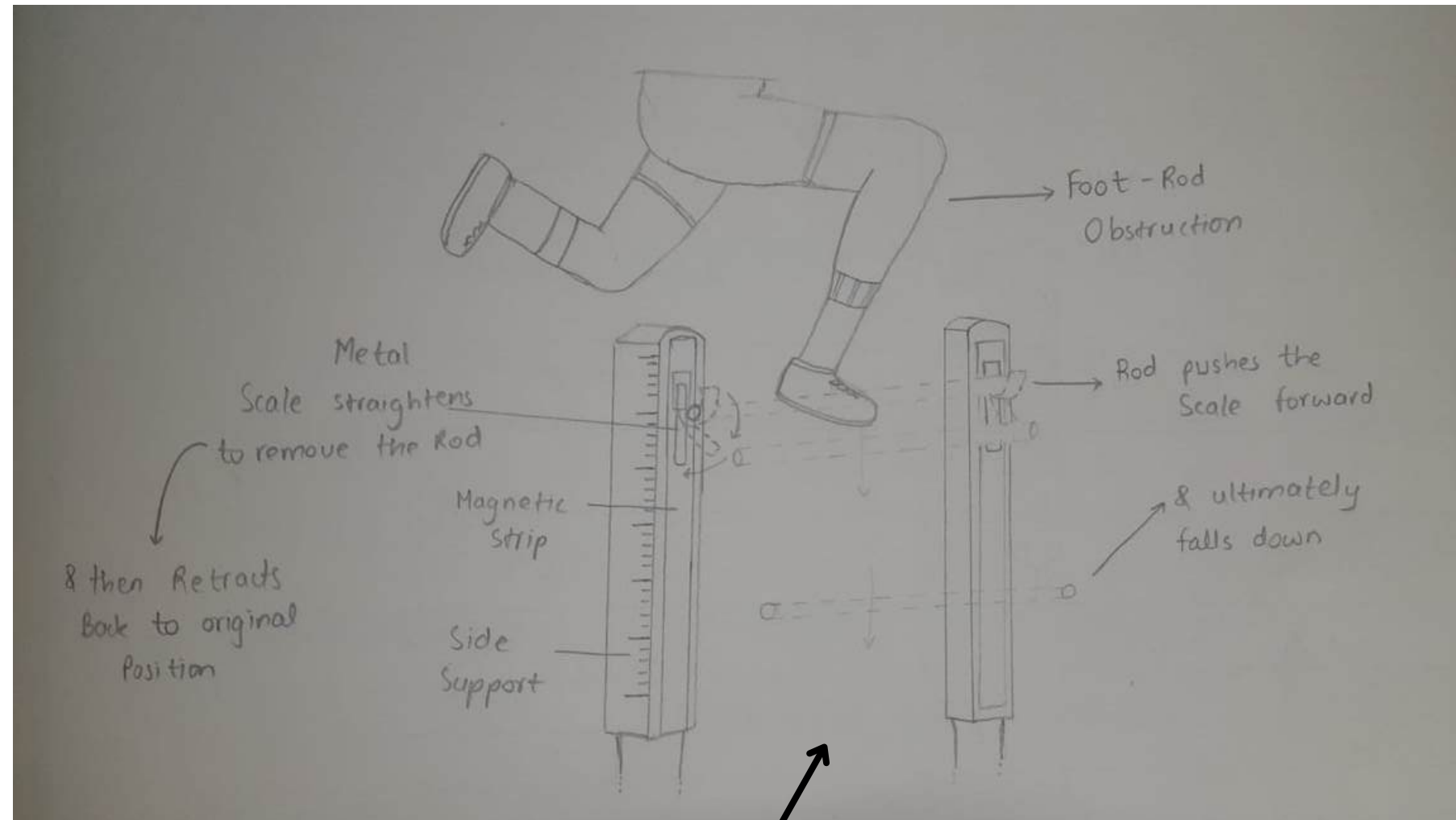
MOCK-UP 3: SKETCHES



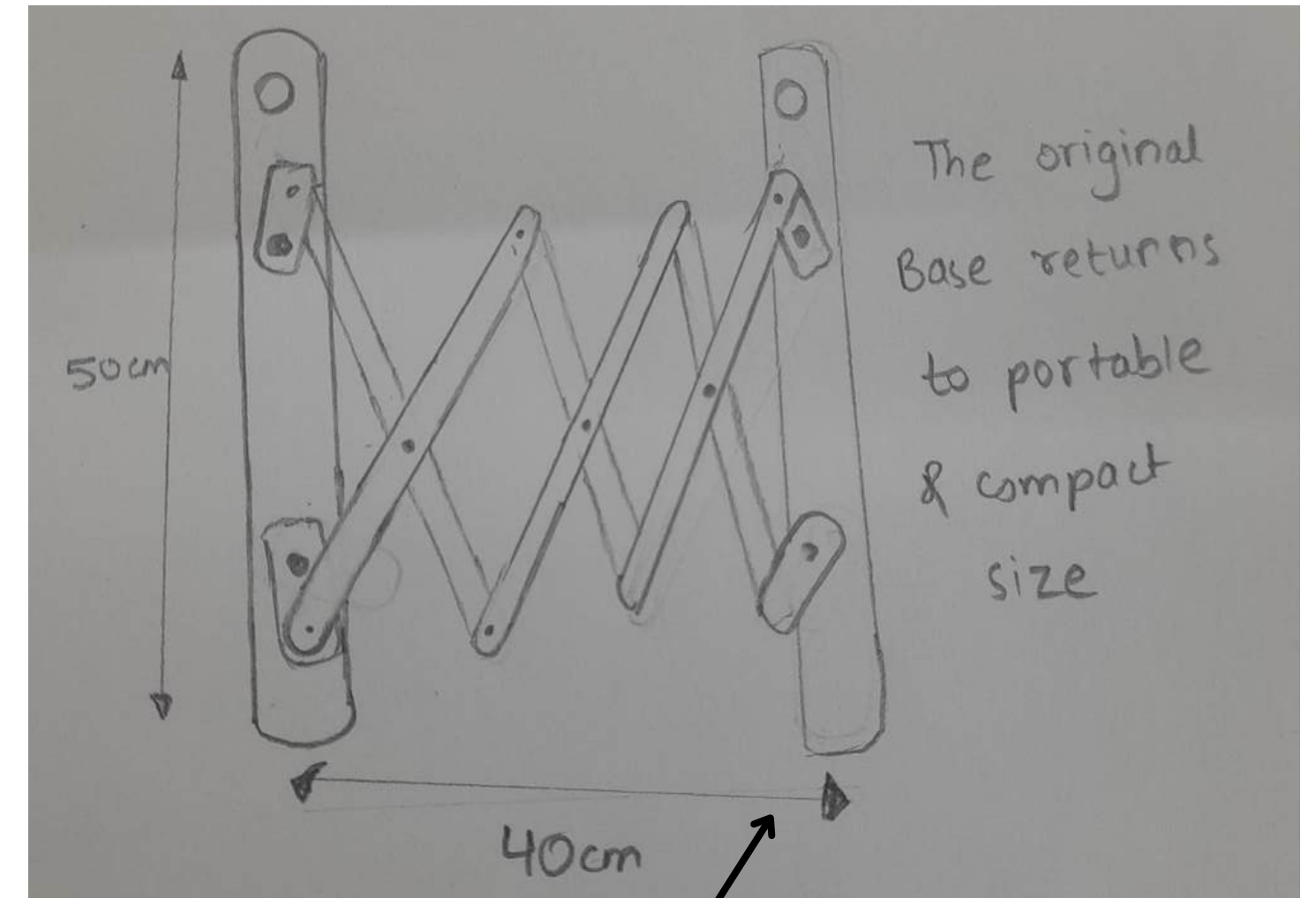
Metal strips with a radium scale are attached to the side bars, depicting the hurdle's height, while the rod fits between the hollow sections of the magnetic strips.

The base working is based on pivot – scissor mechanism.





Rollable scale and magnet strip mechanism as depicted in the sketches prevents athletes from tripping when the rod is touched.



It can be compressed to make it compact. (Portable)

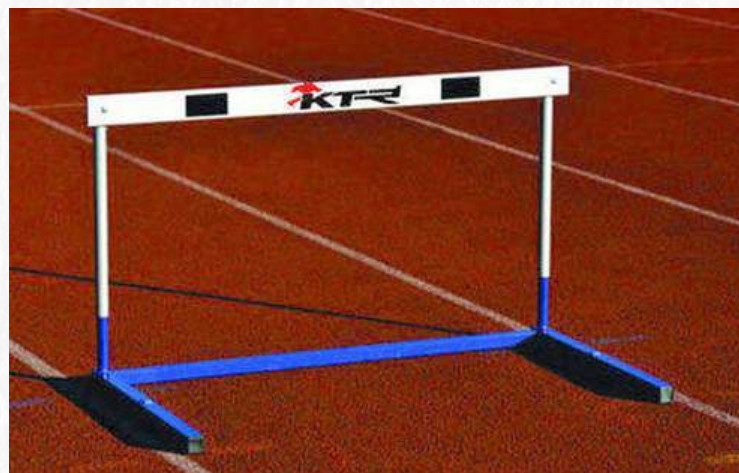
RESEARCH



Online interview with athlete coach of IITGN

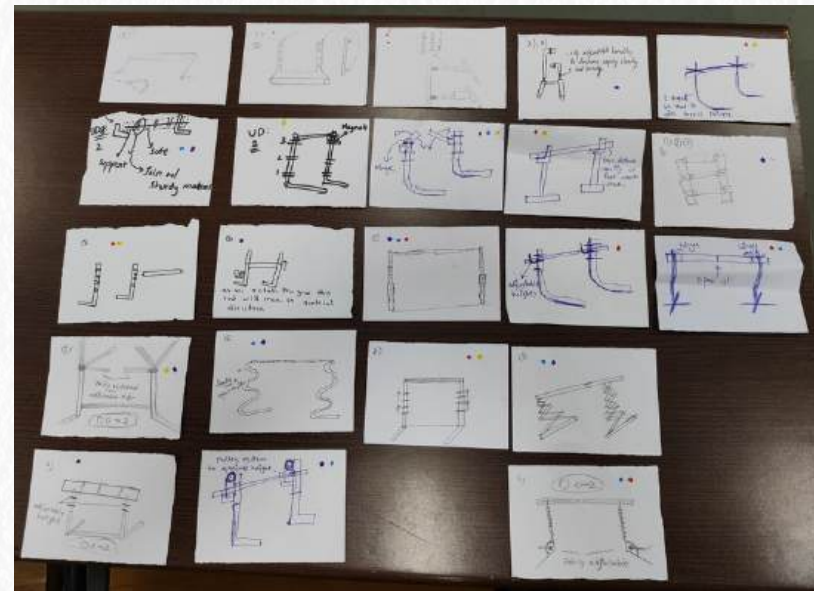


Online survey of students



Analyzed the data evaluation conducted by various companies.

IDEATION

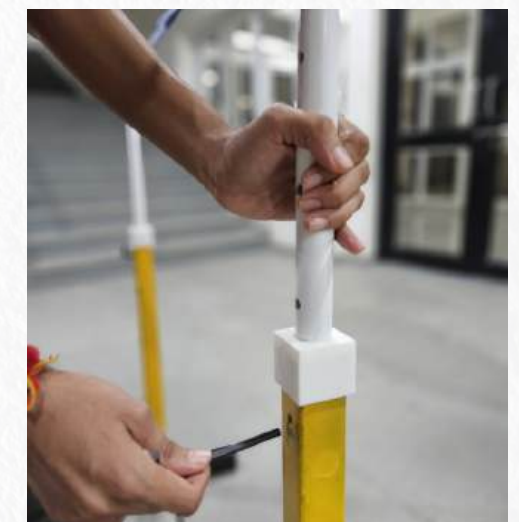
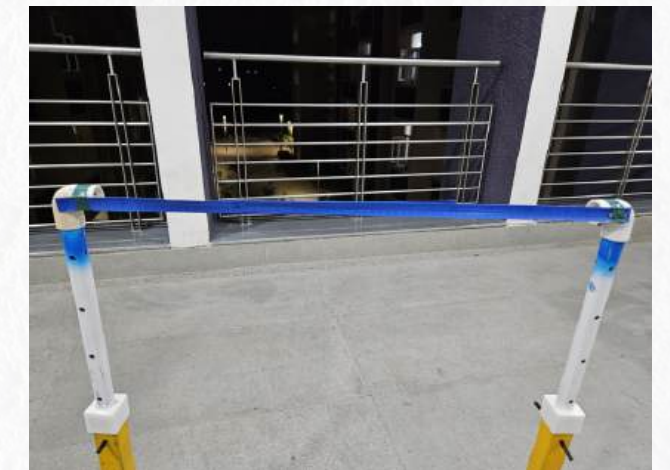


The entire team made 100 sketch chits during the DIP lab

Three of them were selected through voting for mock-ups, considering each design's coverage of most design opportunities and the inclusion of variable mechanisms in each mock-up.

FINAL PRODUCT

Our group decided to take the safety feature from the second mockup, the height adjustment feature from the first mock-up, and the portability aspect from overall ideations.



TIME LINE

1
Removing rust
from MS
channels

3 Drilling holes
for connecting
bar and height
adjustability

5 Making joints
for PVC and
side bars using
3D printing

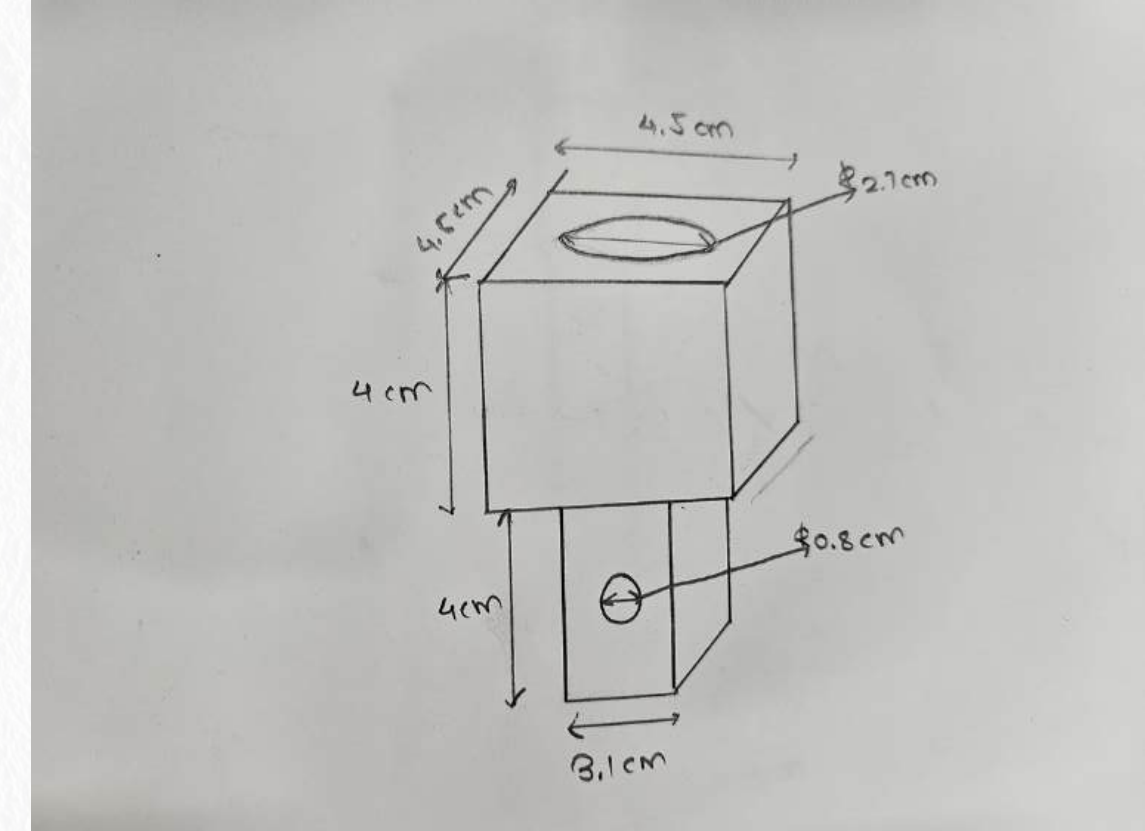
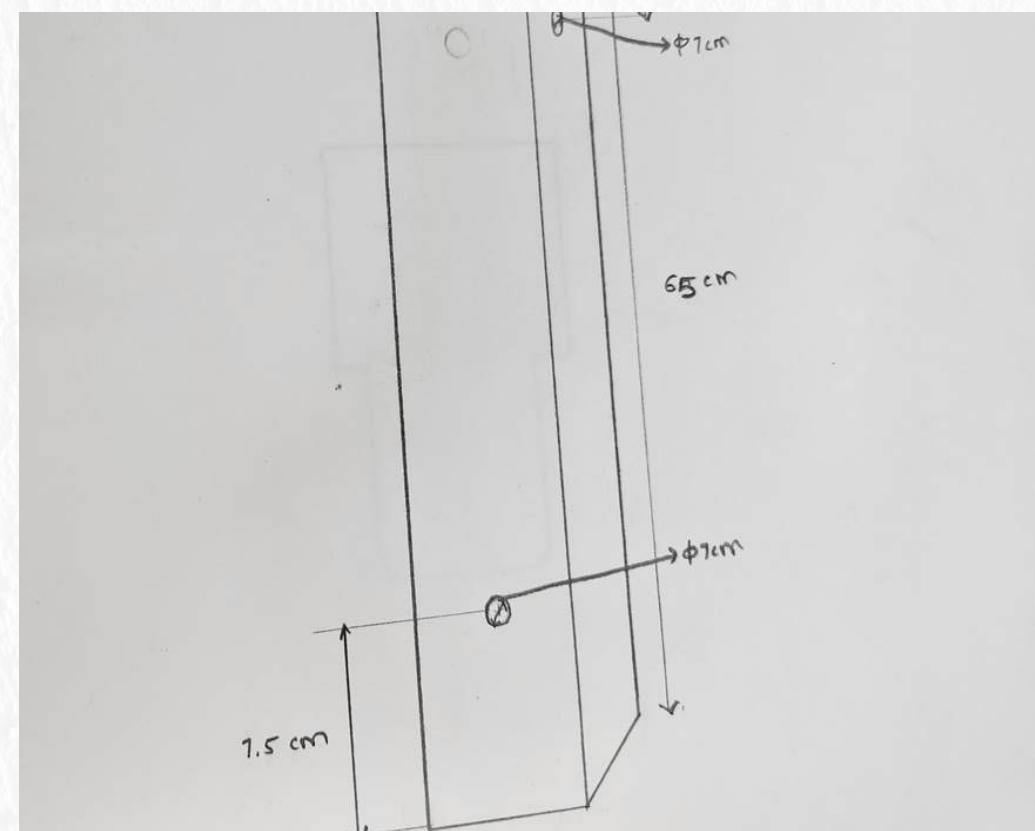
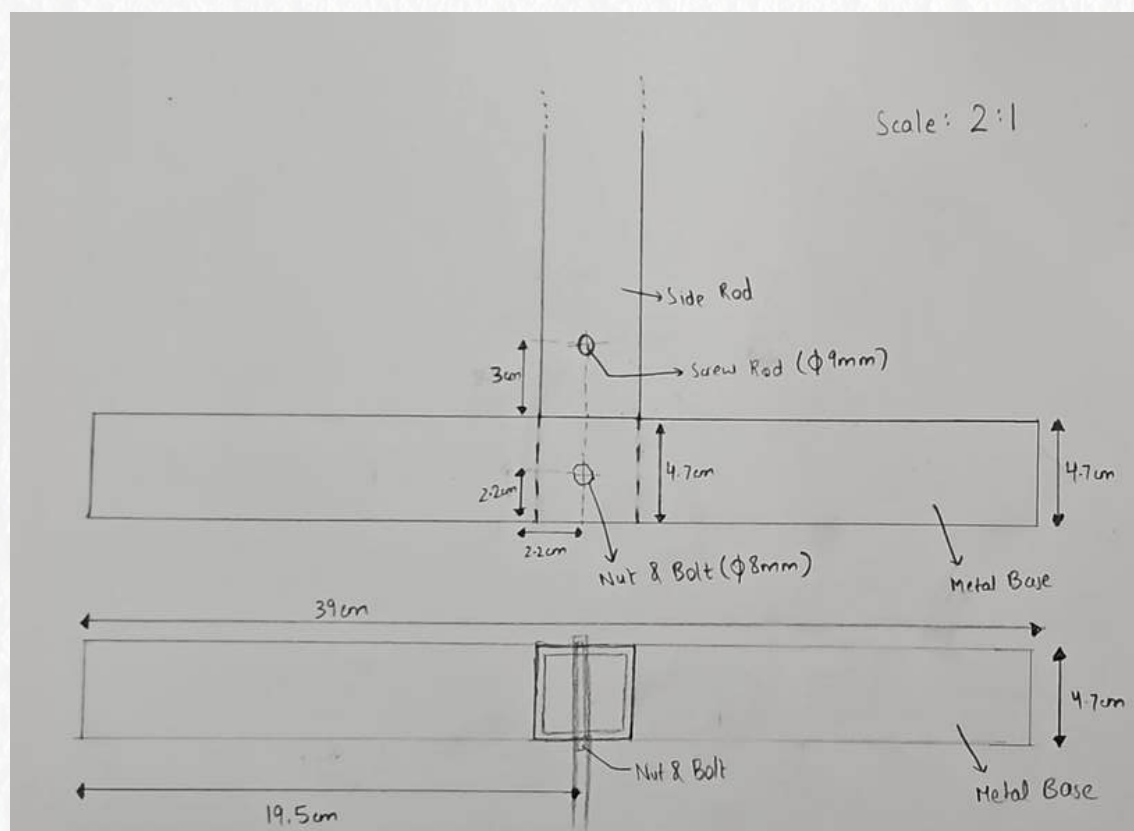
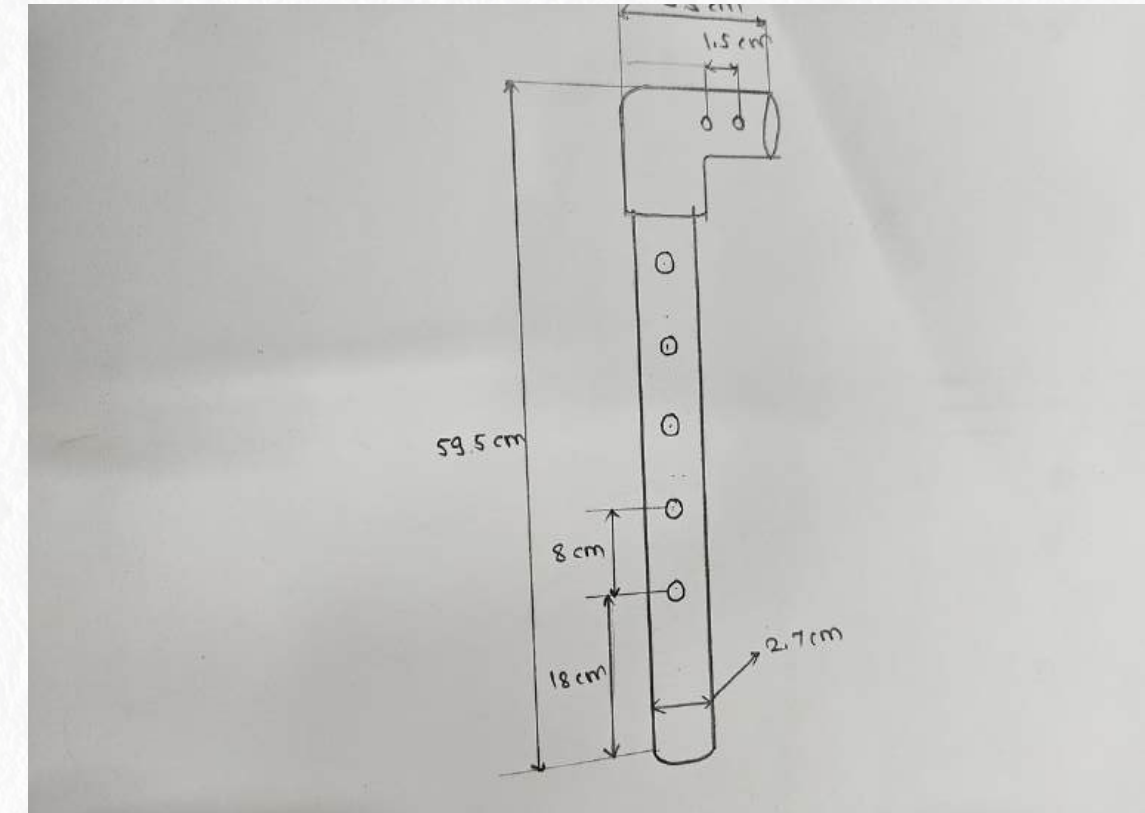
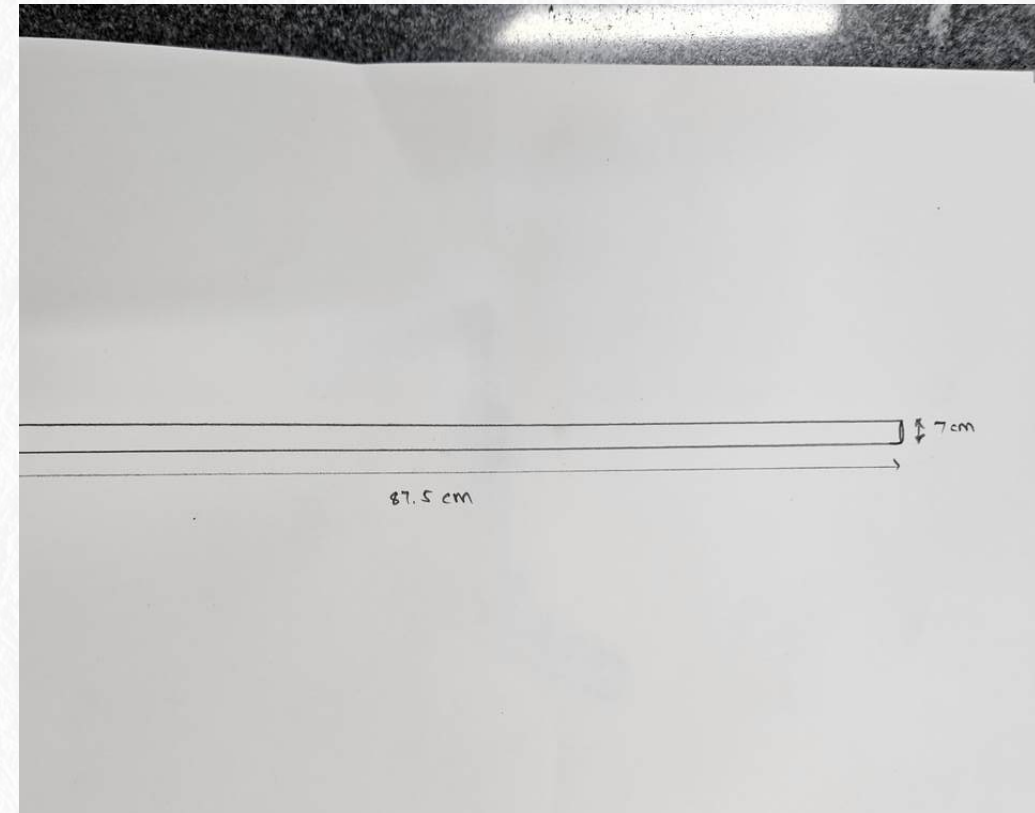
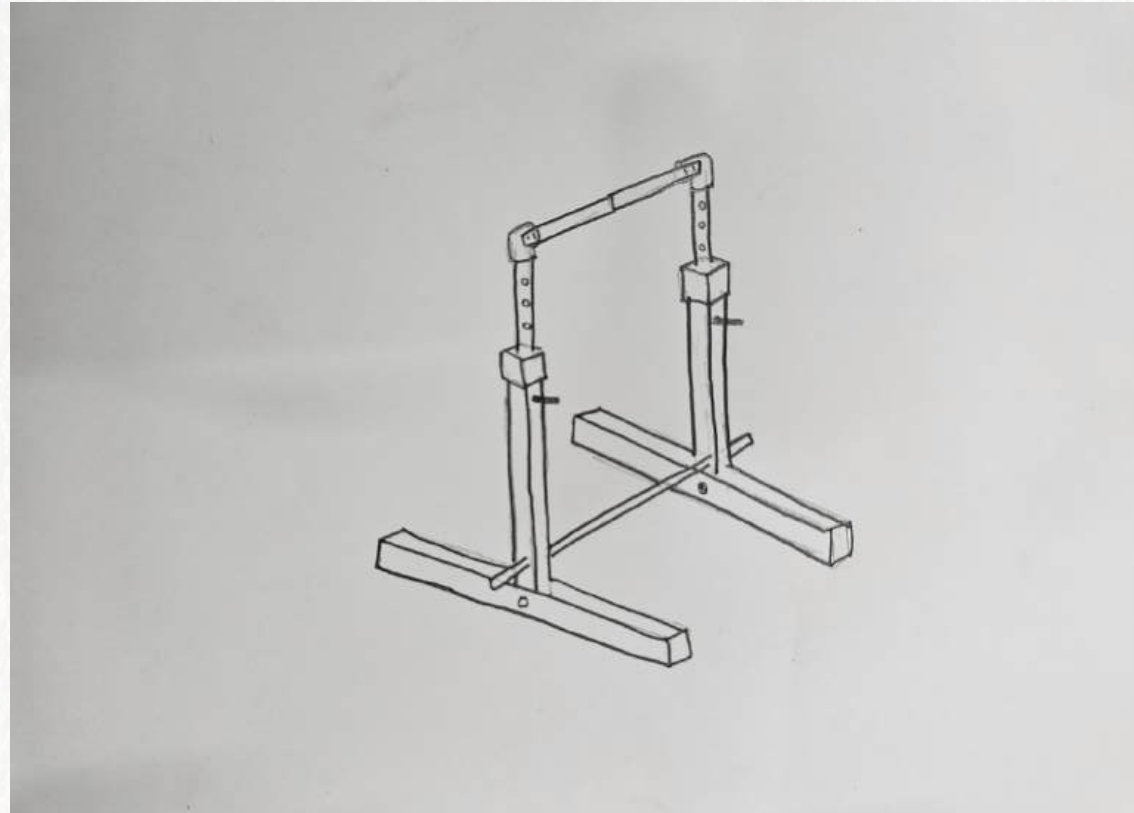
2 Cutting MS
channels for
the base and
side bars

4 Making rollable
scale from
measuring tape
and joining them
with PVC pipes

6 Used antirust
spray paint for
finishing

FINAL CONCEPT

SKETCHES



FINAL CONCEPT

Addressing Design Opportunities

- 1) **Safety** – The bar of hurdle is replaced with a pair of retractable scales which prevents the tripping of athlete by preventing the loss of momentum.
- 2) **Height Adjustability** – The supporting rods on the side are equipped with holes which provide height adjustability feature to the athlete.
- 3) **Portability** – The entire model can be disassembled easily making it easy to carry. Every part is connected with either nuts and bolts or some simple joining mechanisms.

FINAL CONCEPT: DETAILING

Usability Detailing

1. Safety Features

- **Soft Rollable/Retractable Scale on Top**
 - **Impact Absorption:** This feature minimizes the risk of injuries when the hurdle is struck, ensuring a safe training environment.

2. Portability and Assembly

- **Bolt-and-Locking Mechanism:**
 - **Ease of Assembly:** The modular bolt system allows for intuitive setup without specialized tools.
 - **Dismantling Simplicity:** Disassembly is equally straightforward, aiding in storage and transport.

[Here is link for retractable scale demonstration](#)

[Here is link for bolt and locking demonstration](#)

FINAL CONCEPT: DETAILING

Usability Detailing

3. Height Adjustment via Concentric Rods and L-Key Locking Mechanism

- **Precision Adjustments:** Multiple pre-drilled holes in the rods ensure precise height settings tailored to the athlete's training requirements.
- **Secure Locking:** The L-key mechanism ensures a firm hold, preventing accidental changes during use.
- **Ease of Operation:** While the use of an L-key requires an additional step, the process is straightforward and intuitive for users.
- **Durability:** Metal rods offer sturdiness, while the concentric design ensures alignment stability.

[Here is link for height adjustability demonstration](#)

FINAL CONCEPT: DETAILING

Ergonomic Factors

1. Athlete-Centric Design

- **Soft Top for Injury Prevention:**

- The rollable scale prevents fear of injury, encouraging athletes to focus fully on their performance.
- It ensures safety for younger athletes or beginners who may have inconsistent form.

2. User Interaction with the Mechanisms

- **L-Key System:**

- **Ease of Use:** The L-key is a small, ergonomic tool that's easy to handle. A textured grip or magnetic attachment could further enhance usability.
- **Safety:** The locking system prevents unintended adjustments during training.

FINAL CONCEPT: DETAILING

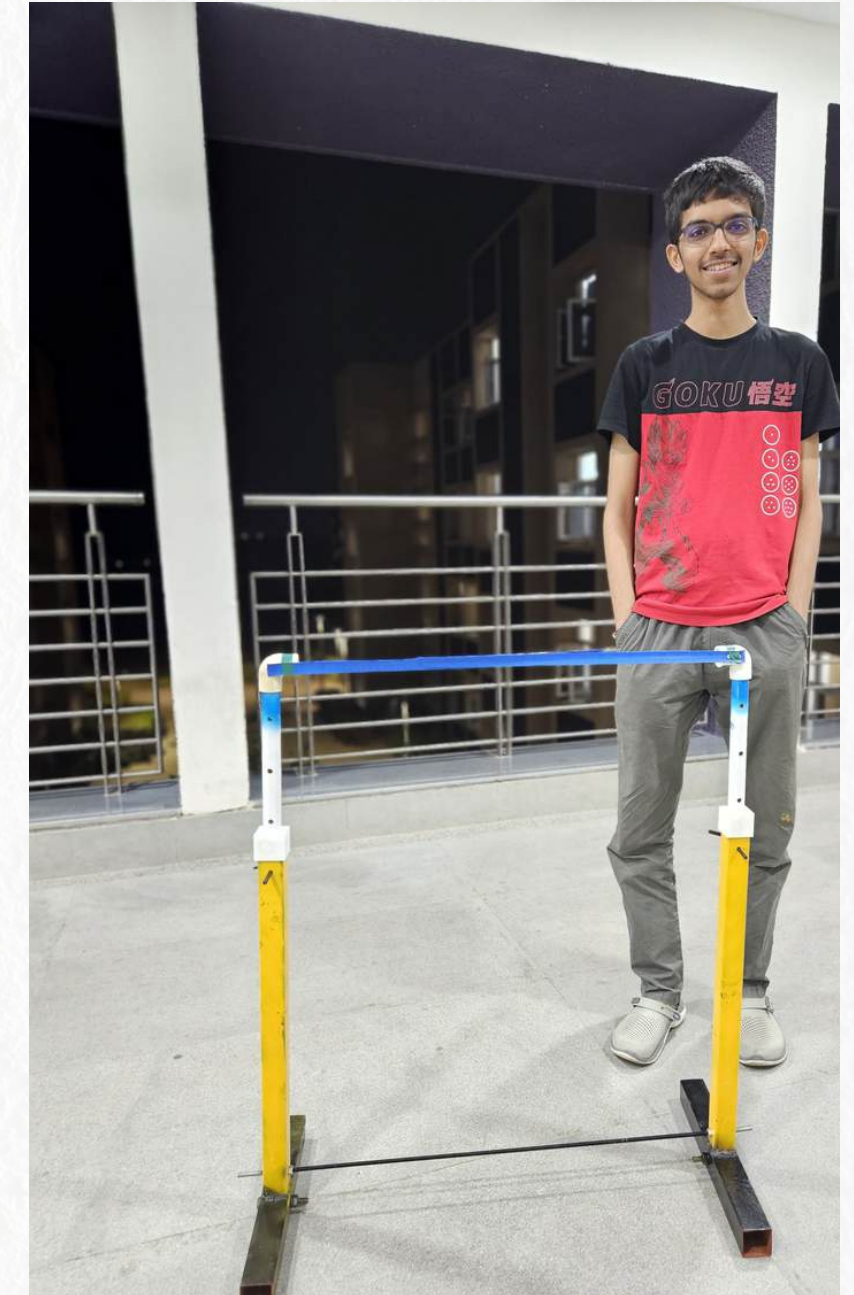
Ergonomic Factors

3. Visibility and Feedback

- **Bright Colors:** High-visibility colors ensure the hurdle is easily noticeable in diverse environments, reducing accidental collisions.

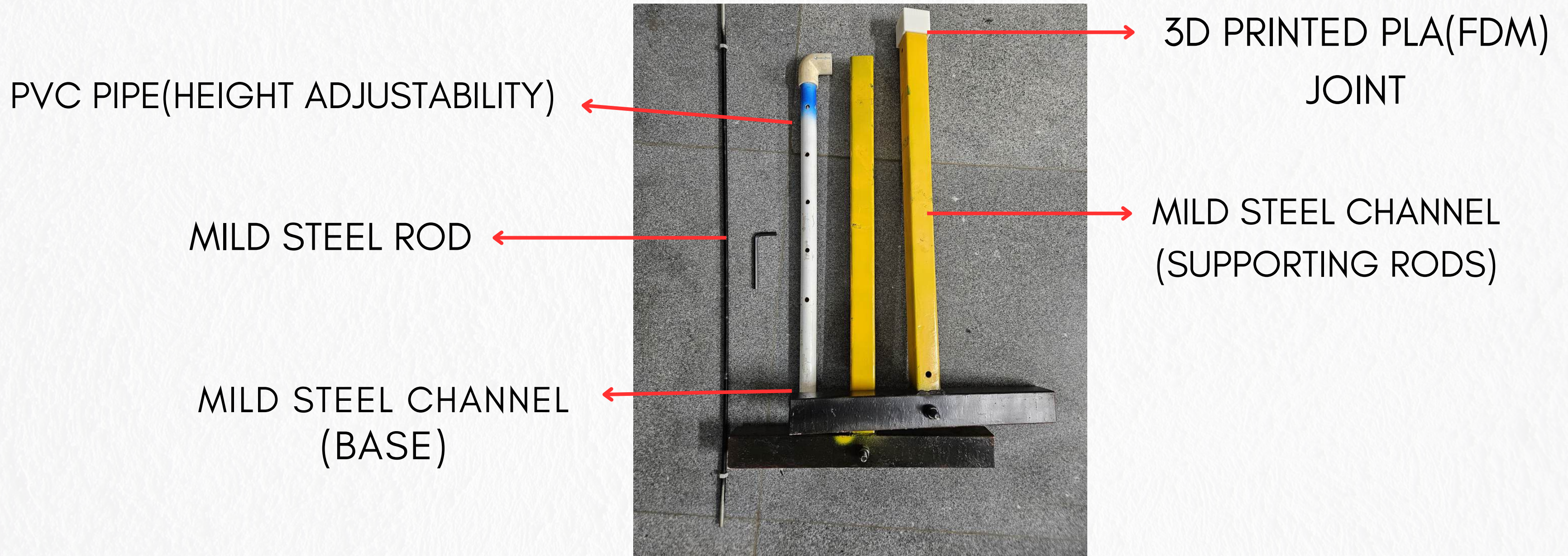
4 .Material Comfort and Handling

- **Smooth Edges:** Rounded edges on rods, bolts, and the retractable scale enhance user comfort and prevent cuts or abrasions.



FINAL PROTOTYPE

Materials Used



FINAL PROTOTYPE

Trades used



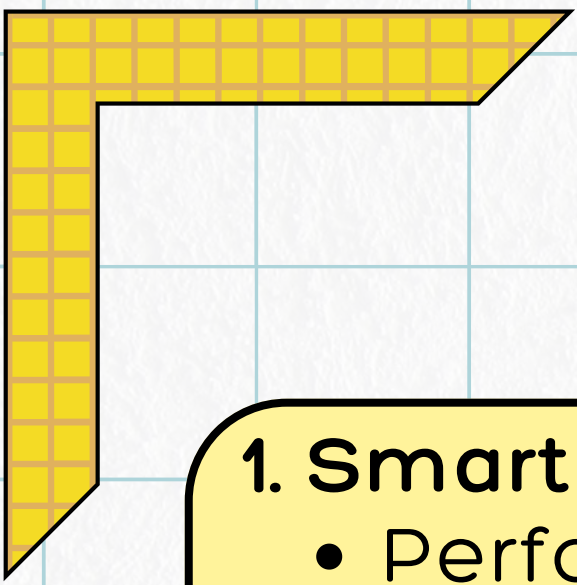
THE JOINT OF THE HURDLE MADE USING **3D PRINTING(FDM)**

HEIGHT ADJUSTABILITY HOLES USING **SHEET METAL BENDING**



CUTTING AND GRINDING OF BASE USING **POWER TOOL METAL**



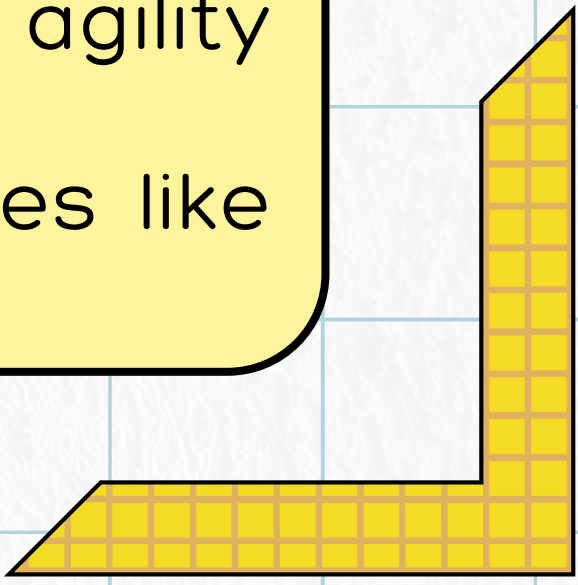



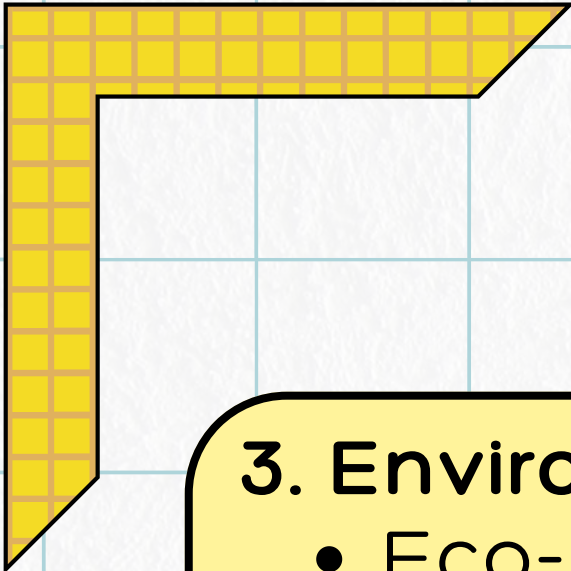
FUTURE SCOPE

1. Smart Technology Integration

- Performance Tracking: Equip the hurdle with sensors to measure the athlete's speed, jump height, and stride length during training.
- Real-Time Feedback: Use auditory or visual signals to notify athletes about their technique, such as if they're too close or jumping too low.

2. Multifunctionality

- Versatility for Multiple Sports: Adaptable designs that cater to sports beyond athletics, such as soccer, rugby, or basketball agility drills.
 - Fitness Integration: Use hurdles for general fitness activities like plyometric training or strength conditioning.
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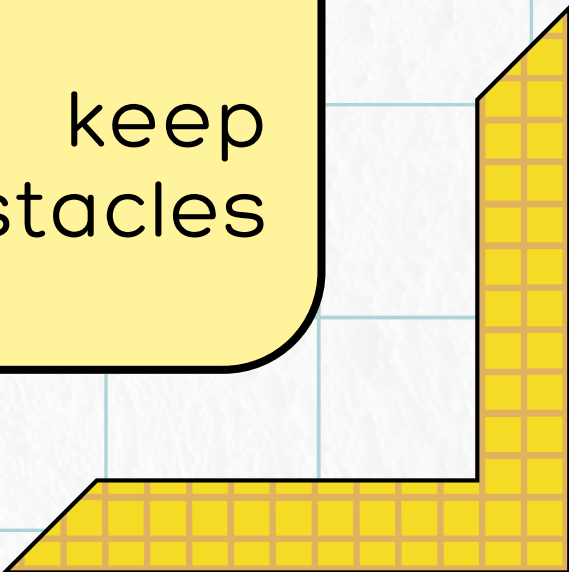



FUTURE SCOPE

3. Environmental Sustainability

- Eco-Friendly Materials: Use sustainable, durable materials that reduce the product's environmental footprint.
- Energy Harvesting: Integrate mechanisms to harvest kinetic energy during training, which could power sensors or store energy for future use.

4. Training Scenarios and Gamification

- Interactive Training Modes: Create hurdles that light up or change settings dynamically to simulate competitive conditions.
 - Gamified Learning: Introduce challenges or games to keep training engaging, such as timing athletes or adding obstacles dynamically.
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CONCLUSION

Our main idea was to make a safer hurdle to mainly focus on inclusivity and promote it especially among the people who want to learn hurdles for athletics but fear the risks such as injury. The target user group we had in mind was amateur athletes who were trying to learn and practice without any environmental constraints. Portability and easier accessibility encourage efficient learning and skill development. If the athletic track isn't nearby one can easily carry our hurdles to an empty area or park for further practice. Fostering inclusivity, diversity and participation was main motive of our product.

ACKNOWLEDGEMENTS

- 1) Our mentors and instructors Prof Manasi mam, Prof Rakesh sir and Srinivas bhaiya who have guided us through this truly roundabout path.
- 2) Our fellow peers who have helped us in providing with reviews and concerns which shaped our ideation of the product.
- 3) IIT Gandhinagar for providing us with required resources, tools and machinery to execute the product

