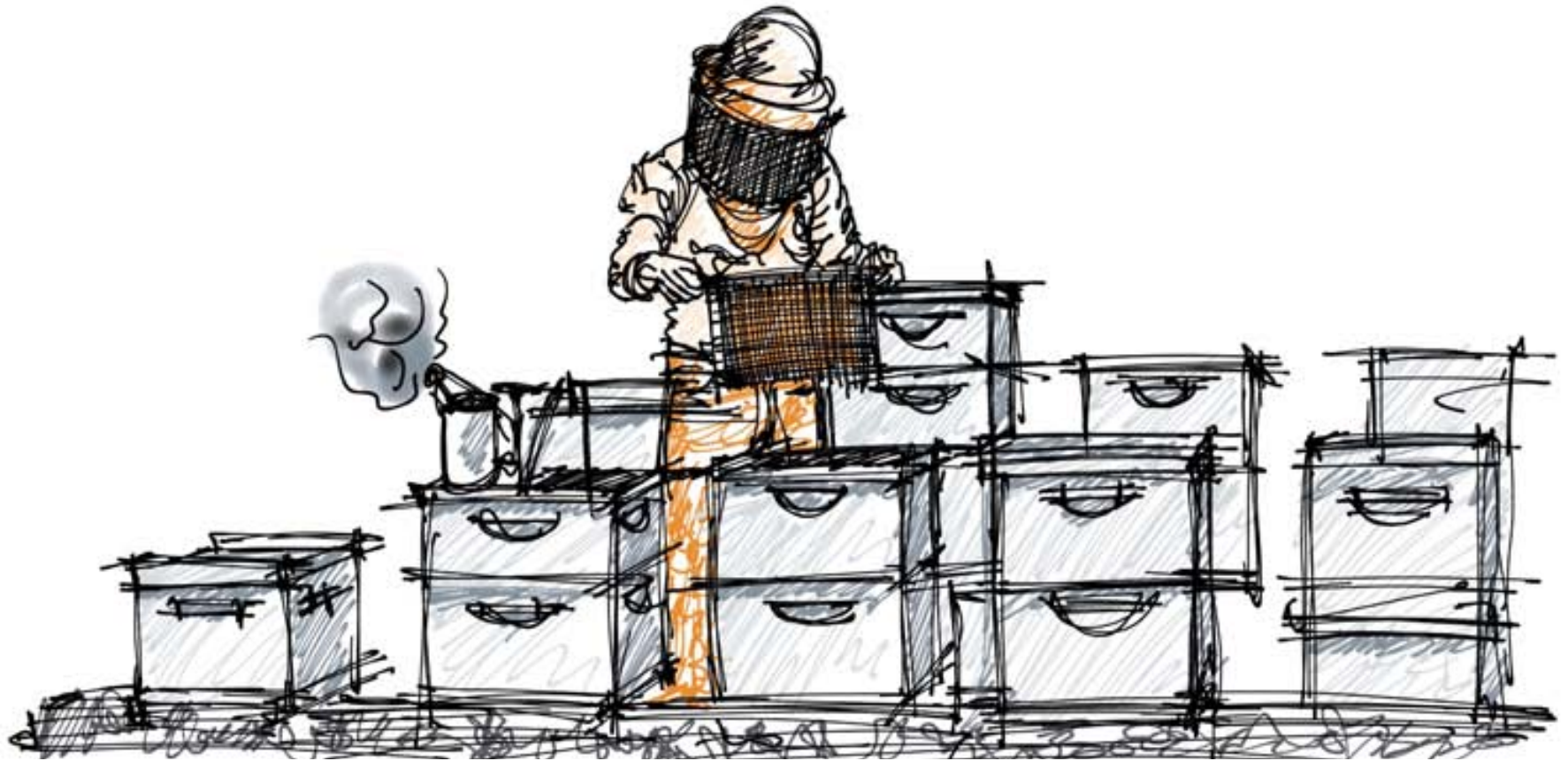




PERSONAL PROTECTIVE EQUIPMENT FOR BEEKEEPERS

Irshath Ahamed K | Prof. Sandesh R



OVERVIEW

1. Introduction
2. Site Visit
3. Issues
4. Concepts
5. Evaluation
6. Fabric study
7. Mock-up
8. Testing
9. Ideations
10. Final Suit

INTRODUCTION

- Beekeeping is the maintenance of honey bee colonies, commonly in hives, by humans.
- A beekeeper (or apiarist) keeps bees in order to collect their honey and other products that the hive produces.

INTRODUCTION

- Among all the other accessories, beekeeper's suit is one of the most important tools a beekeeper can have.
- It protects against the stings and helps the beekeeper stay calm when bees get agitated.

INTRODUCTION

INDIAN SCENARIO

- India, one of the largest honey producer and exporter in the world, plays an important role in world honey production and trade.

INTRODUCTION

PRODUCTION OF HONEY IN TONNE





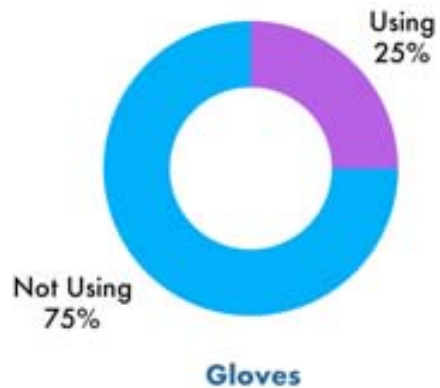
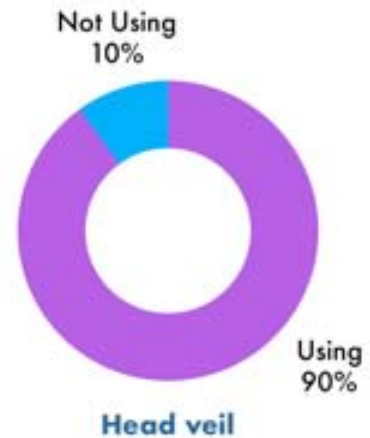
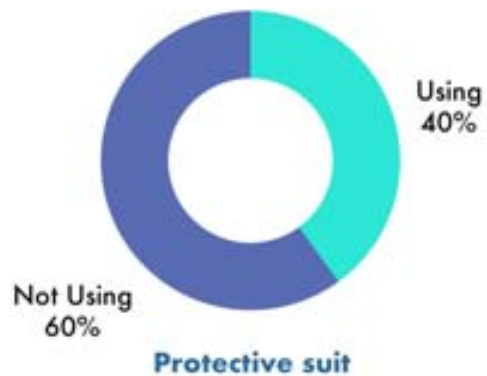






INTRODUCTION

SURVEY ON BEE SUIT WEARERS





SITE VISIT

CENTRE OF SCIENCE FOR VILLAGES

- Bridging the gap between technologies from national laboratories and rural mud huts.
 1. Rural housing
 2. Sanitation
 3. Liquid waste management
 4. Non Conventional energy
 5. Eco technologies
 6. Rural Industries
- One of the production unit is the honey section

SITE VISIT

HONEY SECTION AT CSV, WARDHA



SITE VISIT

THE SUIT AT CSV, WARDHA



SITE VISIT

ACTIVITY 1



SITE VISIT

ACTIVITY 2

1



2



3



4



5



6



SITE VISIT

ACTIVITY 3





ISSUES

1

WEARING ORDER



5



2



6



3



4

ISSUES

LACK OF VENTILATION

CANVAS

- ☐ Non breathable.
- ☐ Heavy.
- ☐ Stiff.
- ☐ Non flexible.
- ☐ Expensive.

ISSUES

VIEWING ANGLE



ISSUES

GLOVES AND SLEEVES



- Non breathable.
- Thick.
- Difficult to work with.



- Not a suitable elastic.
- Gaps increasing the risk of bees entering.

ISSUES

SUMMARY

- Lack of ventilation.
- Cannot be worn without a second person's help.
- Faulty wearing order.
- Stiff material restricts viewing angle.
- Cumbersome.
- Gloves are not specifically designed for this purpose.
- Gaps at the junctions.

To design and develop a sting proof suit that

- Is made from an appropriate material.
- Is ventilated properly.
- Provides adequate protection from bee stings.
- Cost effective.
- Is intuitive to wear and remove.
- Is cheap and easy to manufacture.



CONCEPTS

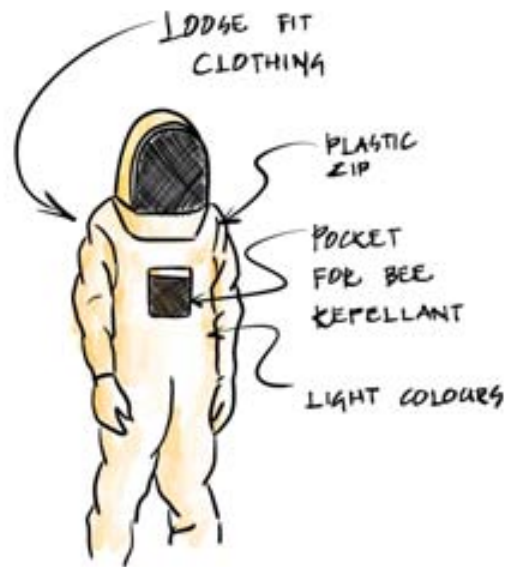
BRAINSTORMING

- Invisibility
- Smoke suit
- Air Flow jacket
- Colour
- Ultrasonic suit
- Camouflage
- Water filled suit
- Pressure difference
- Aluminium foil suit
- Kevlar suit
- Perforated suit
- Military suit
- Fabric Texture
- Industrial thermal suit
- Electrical/Chemical repellent
- Bubble wrap suit
- Electric charge suit
- Jute sac suit
- Mosquito netting
- Hazmat suits
- Lungi type jacket
- Umbrella structure head veil
- Rings all over body
- Use and throw jacket
- Astronaut helmet
- Bear suit
- Bird cage helmet
- Inbuilt fans
- Balloon suit
- Camouflage scent

- 1 Keeping the bees away from the beekeeper by using natural & chemical agents.
- 2 Thick enough so the sting does not reach the skin.
- 3 Strong enough so the sting does not even penetrate.

CONCEPTS

DIRECTION 1



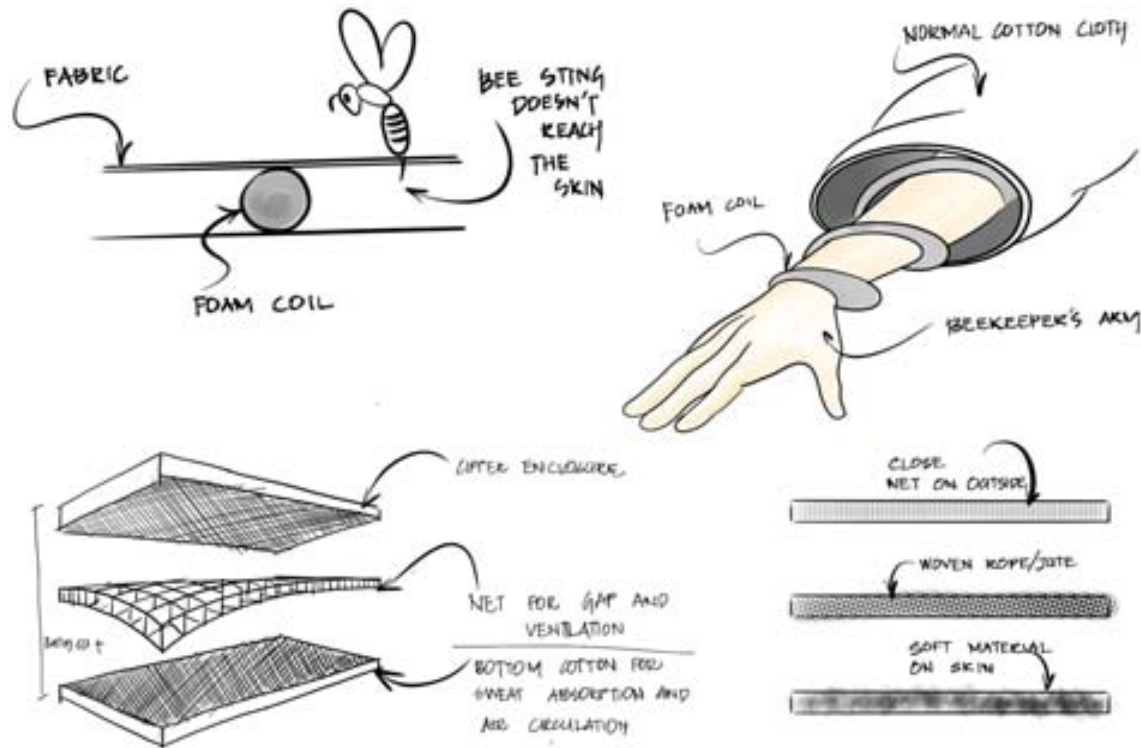
- * - CINNAMON
- * - PEPPERMINT OIL
- * - CAYENNE PEPPER
- * - GARLIC LIQUID
- * - MOTH BALLS
- * - SPICES
- * - BABY POWDER
- * - TEA TREE OIL

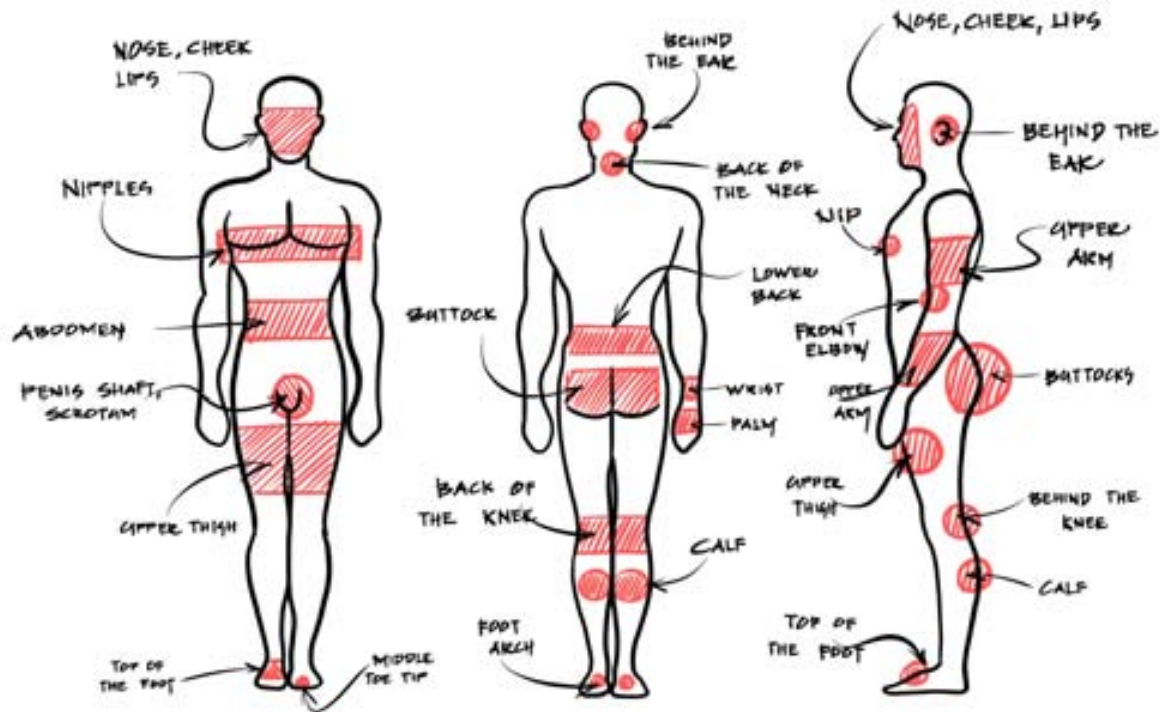


- * - FLOWER SCENT
- * - FOOD ODOUR
- * - SWEET SMELL

CONCEPTS

DIRECTION 2

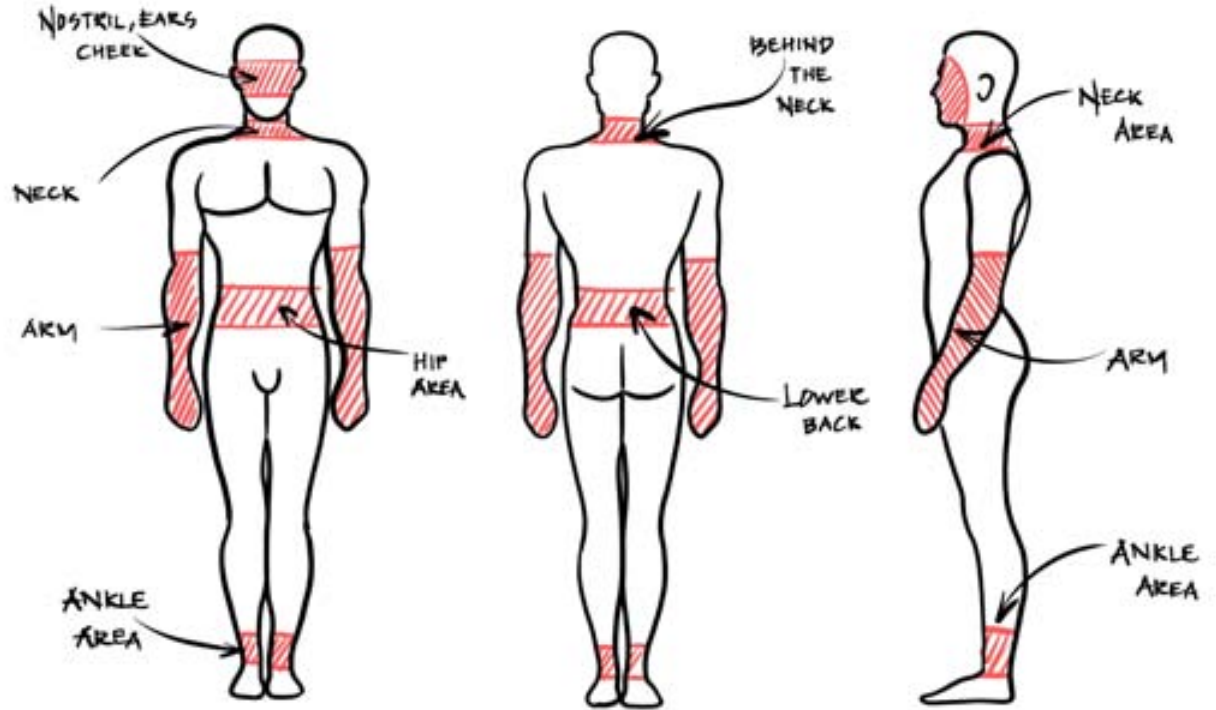




MOST PAINFUL AREAS

CONCEPTS

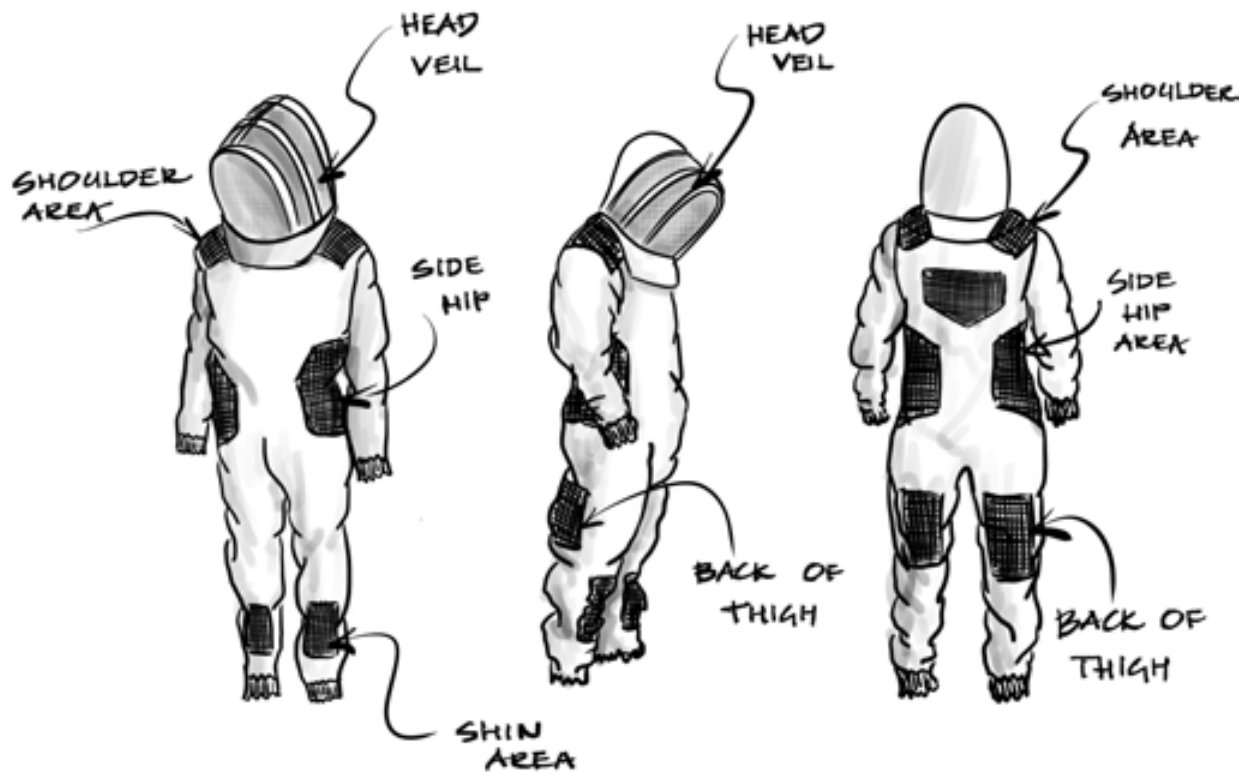
DIRECTION 3



MOST STUNG AREAS

CONCEPTS

DIRECTION 3



POTENTIAL AREAS FOR VENTILATION MESH



EVALUATION

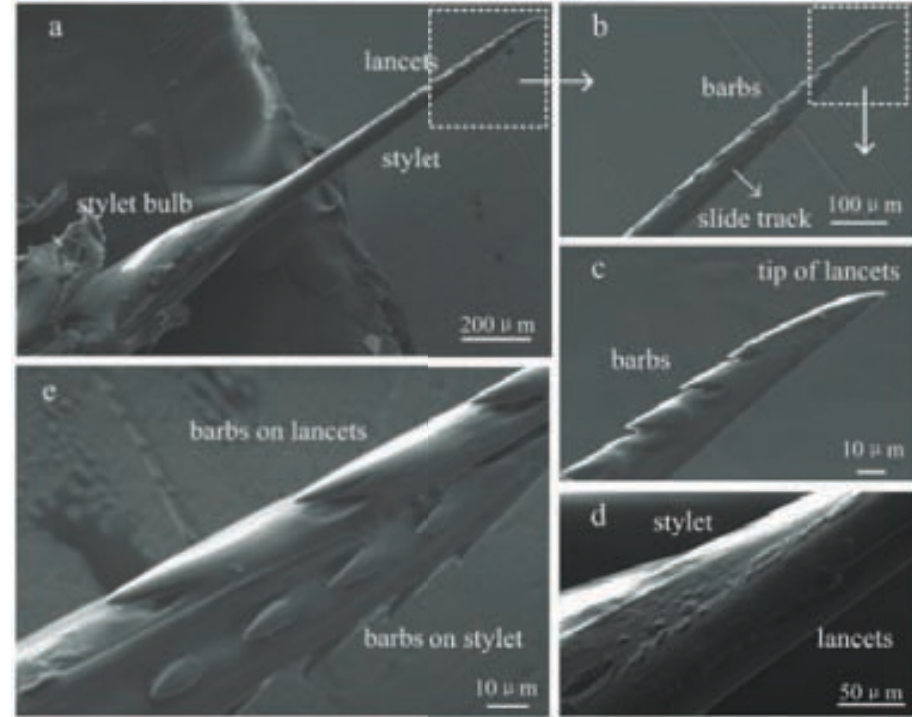
- 1 Keeping the bees away from the suit by using natural & chemical agents.
 - Expensive.
 - Weakens and kills bees.
 - Suit anyways.
- 2 Thick enough so the stinger does not reach the skin.
- 3 Strong enough so the sting does not even penetrate.
 - Existing suit.
 - Not breathable.
 - Prone to bee sting.

2

Thick enough so the stinger does not reach the skin.

CONSTRAINTS

- ☐ About 3mm – 4mm thick.
- ☐ Breathable.
- ☐ Lightweight.
- ☐ Flexible.
- ☐ White color.
- ☐ Cheap.





FABRIC STUDY

VENDORS VISITED

Sunrise International, Ghatkopar West.

Payal Creation, Chinchpokli East.

Aala Traders, Nagdevi.

Krishna Corporates, Kalbadevi Road.

Sangeetha Traders, Dharavi.

Natroyal Industries, Kandivali West.

Modi & Patel Filter Fab pvt ltd, Kalbadevi Road.

Tip top Seat covers, Grant Road.

D. Chemet International, Swami Nityanand Road.

Hi tech Furnishing – Ashwin, Santacruz East.

Arrow Technical Textiles Pvt Ltd, Kandivali East.

Riddhi Enterprise, Dahisar East.

Porwal groups, Ichalkaranji.

FABRICS COLLECTED





MOCK - UP

MOCK-UPS MADE



MOCK - UP





TESTING

CRITERIA

General Testing

- Material weight
- Material comfortness
- **Ability withstand Bee stings**
- Bee behaviour on colour
- Bee behaviour when disturbed

Indoor

- **Ventilation**
- Bee behaviour

Outdoor

- **Exposure in sunlight**
- **Ventilation**
- Bee behaviour

TESTING



TESTING



TESTING



TESTING



TESTING



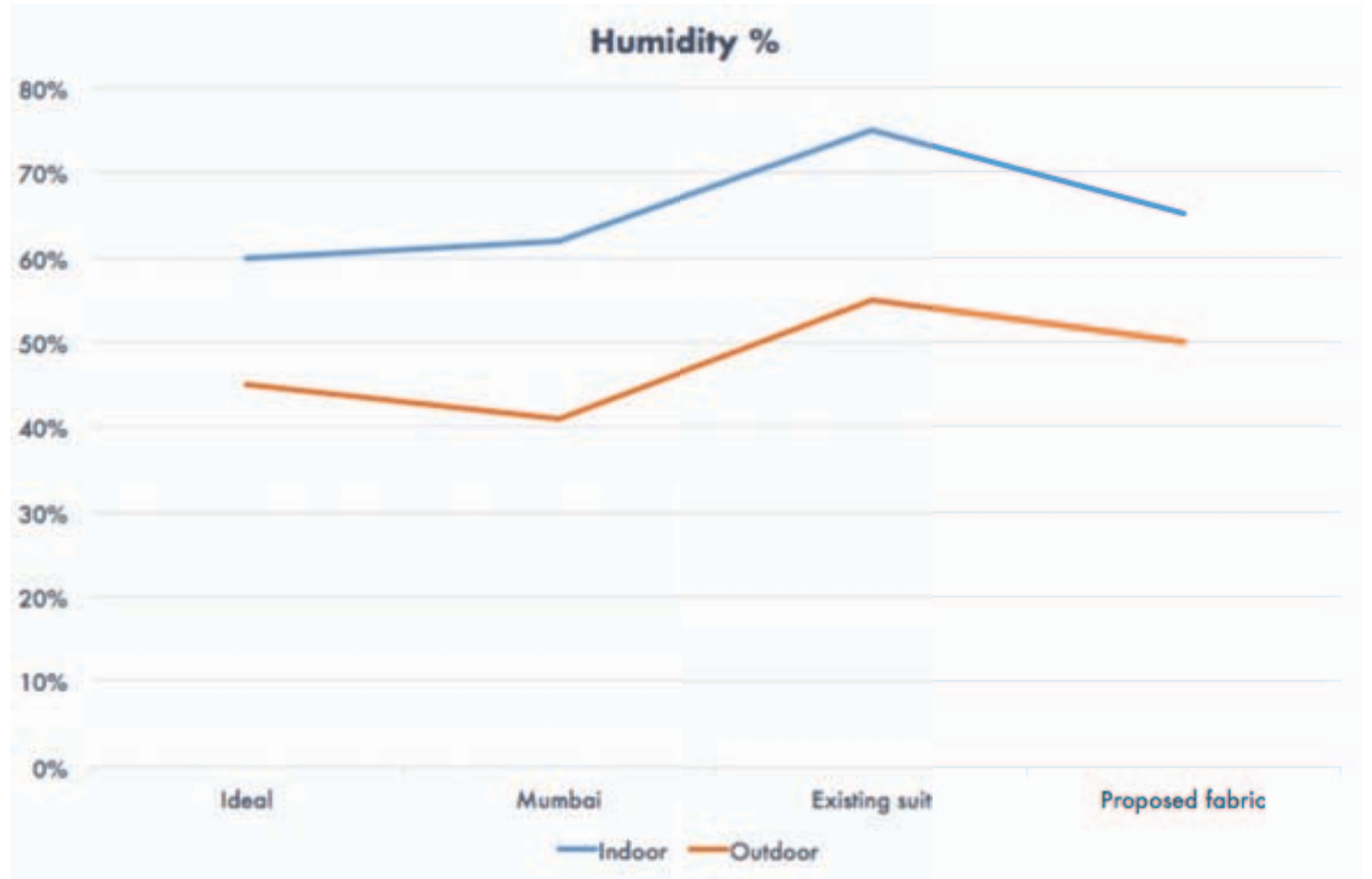
TESTING

HUMIDITY TEST



TESTING

HUMIDITY TEST





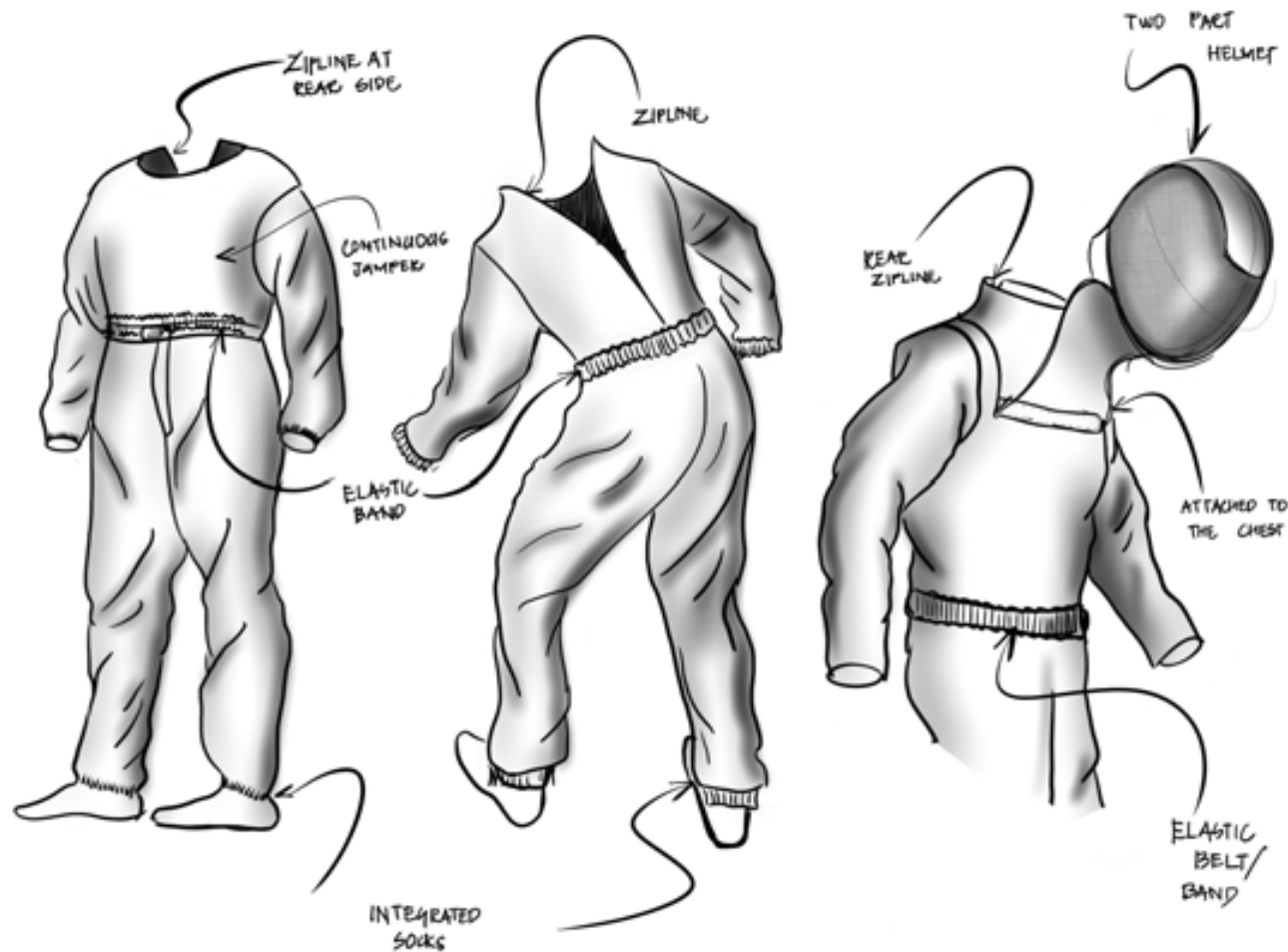
IDEATIONS

UNIFIED SUIT

- Less parts.
- Easy to wear.
- Single person usage.
- User wear the full suit.

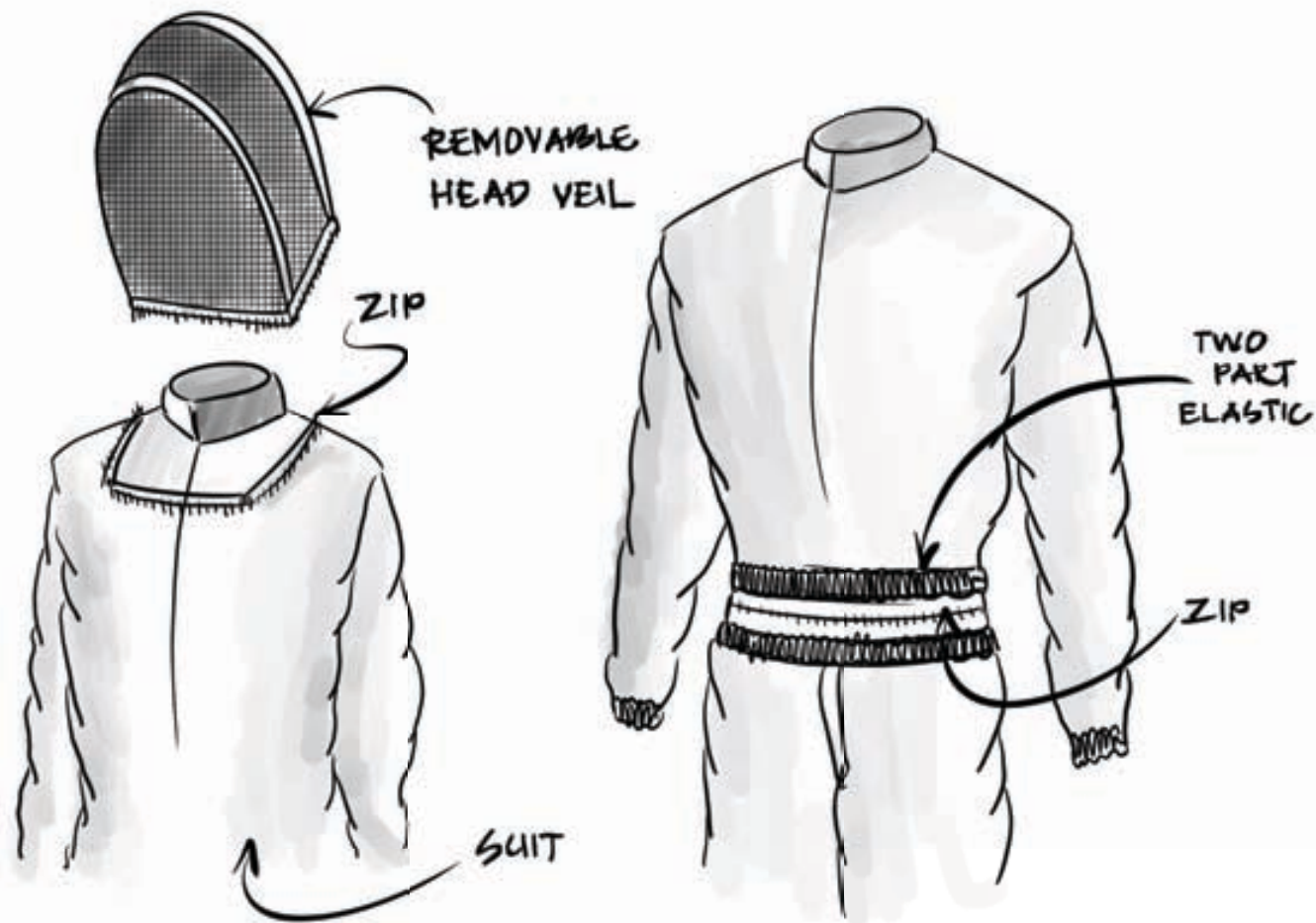
IDEATIONS

UNIFIED SUIT



IDEATIONS

UNIFIED SUIT



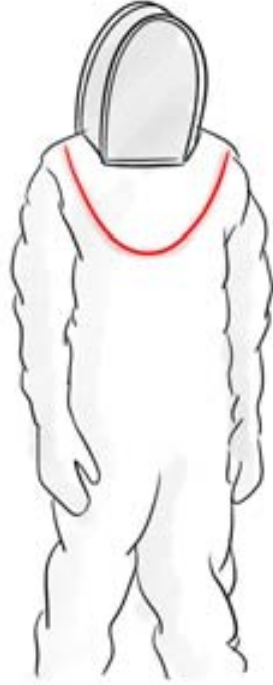
IDEATIONS

UNIFIED SUIT



IDEATIONS

UNIFIED SUIT



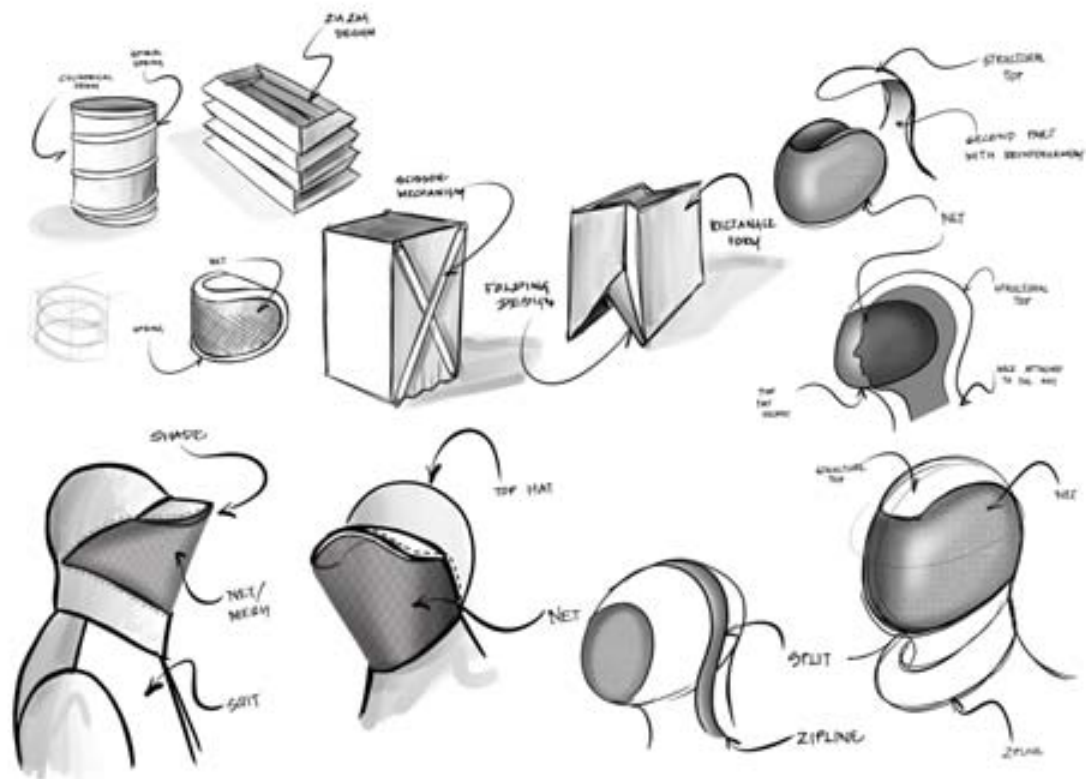
IDEATIONS

UNIFIED SUIT



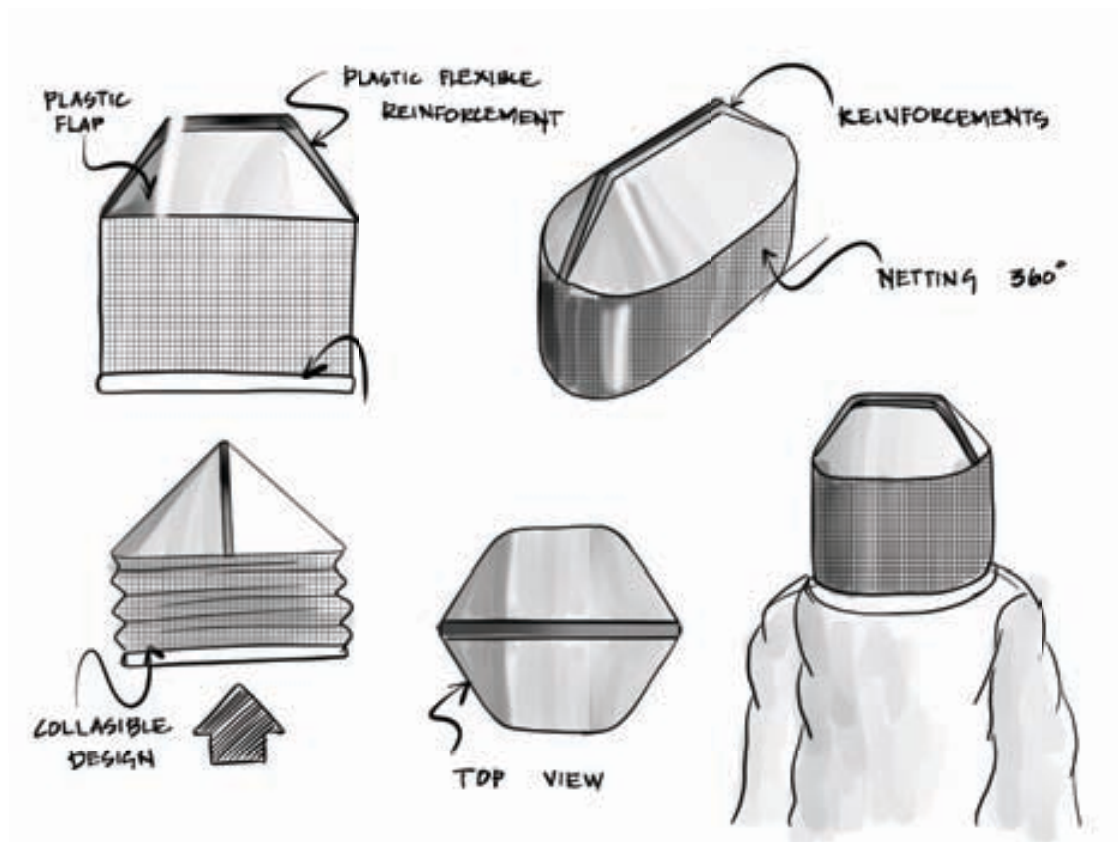
IDEATIONS

HEAD VEIL



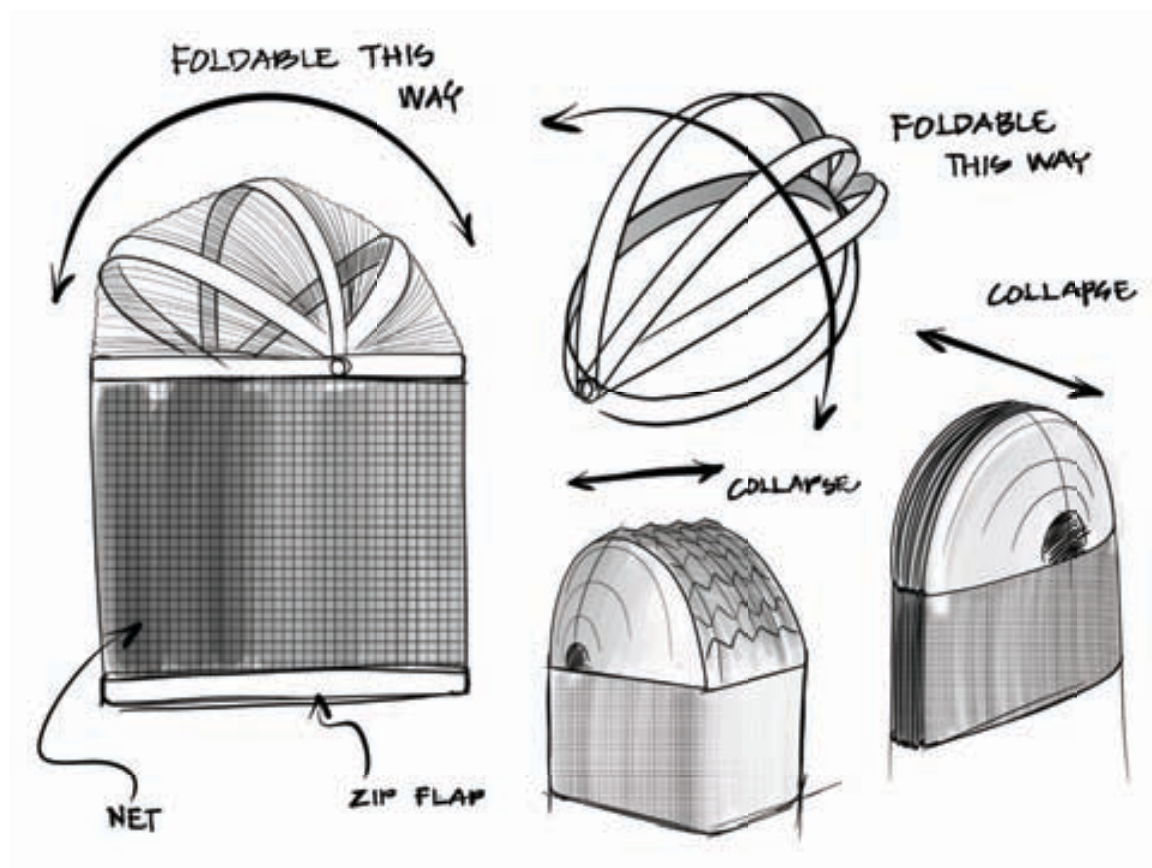
IDEATIONS

HEAD VEIL



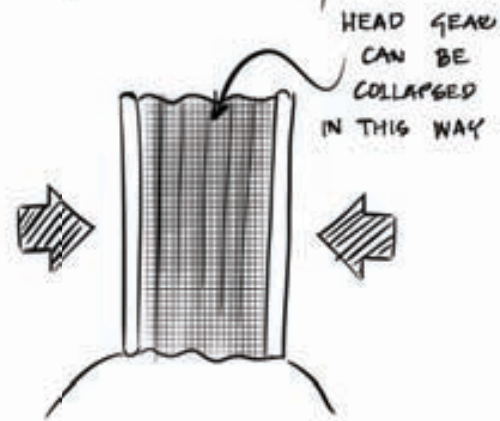
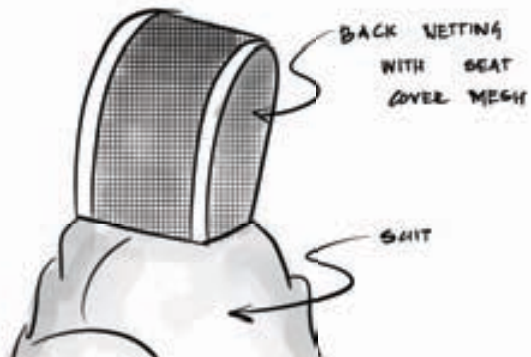
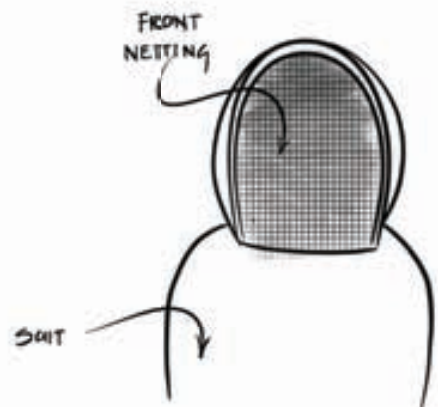
IDEATIONS

HEAD VEIL



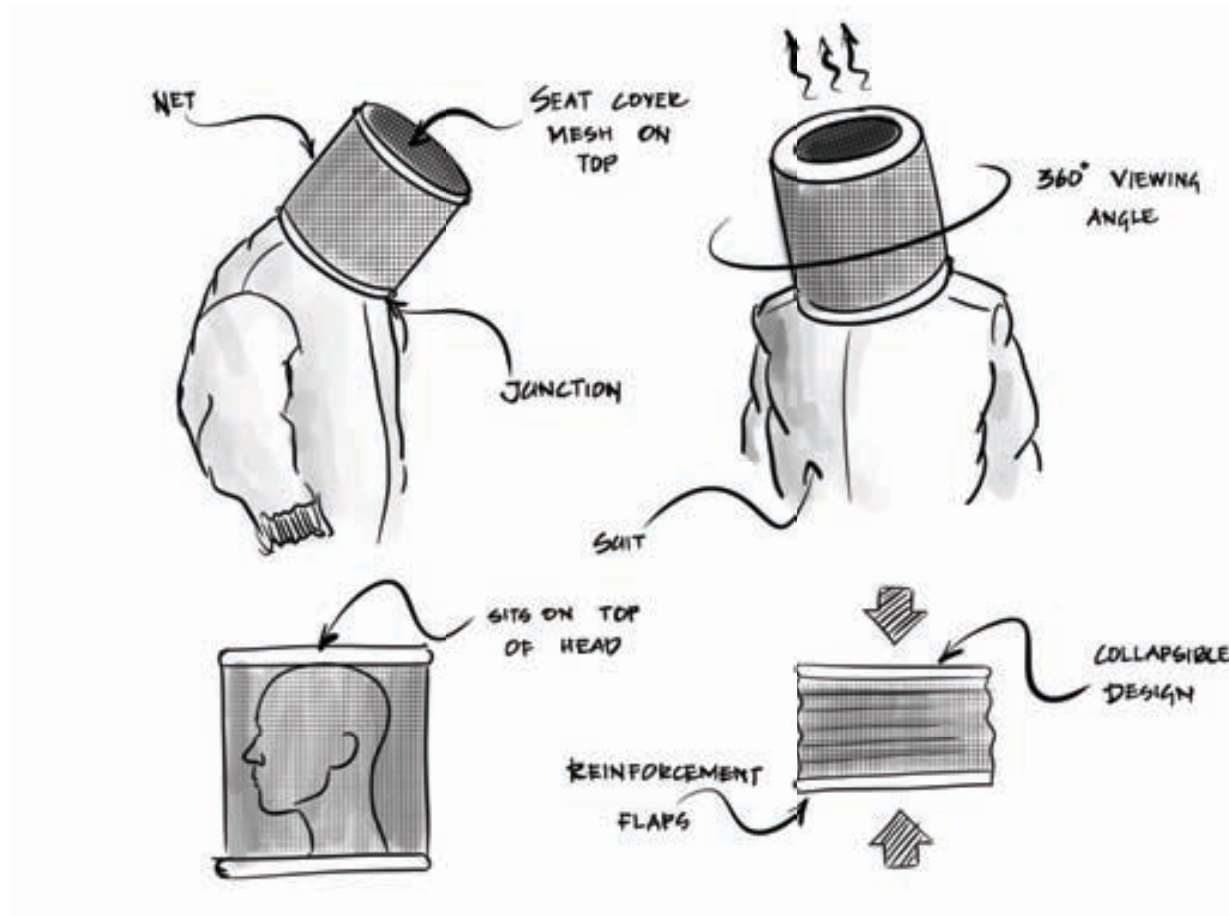
IDEATIONS

HEAD VEIL



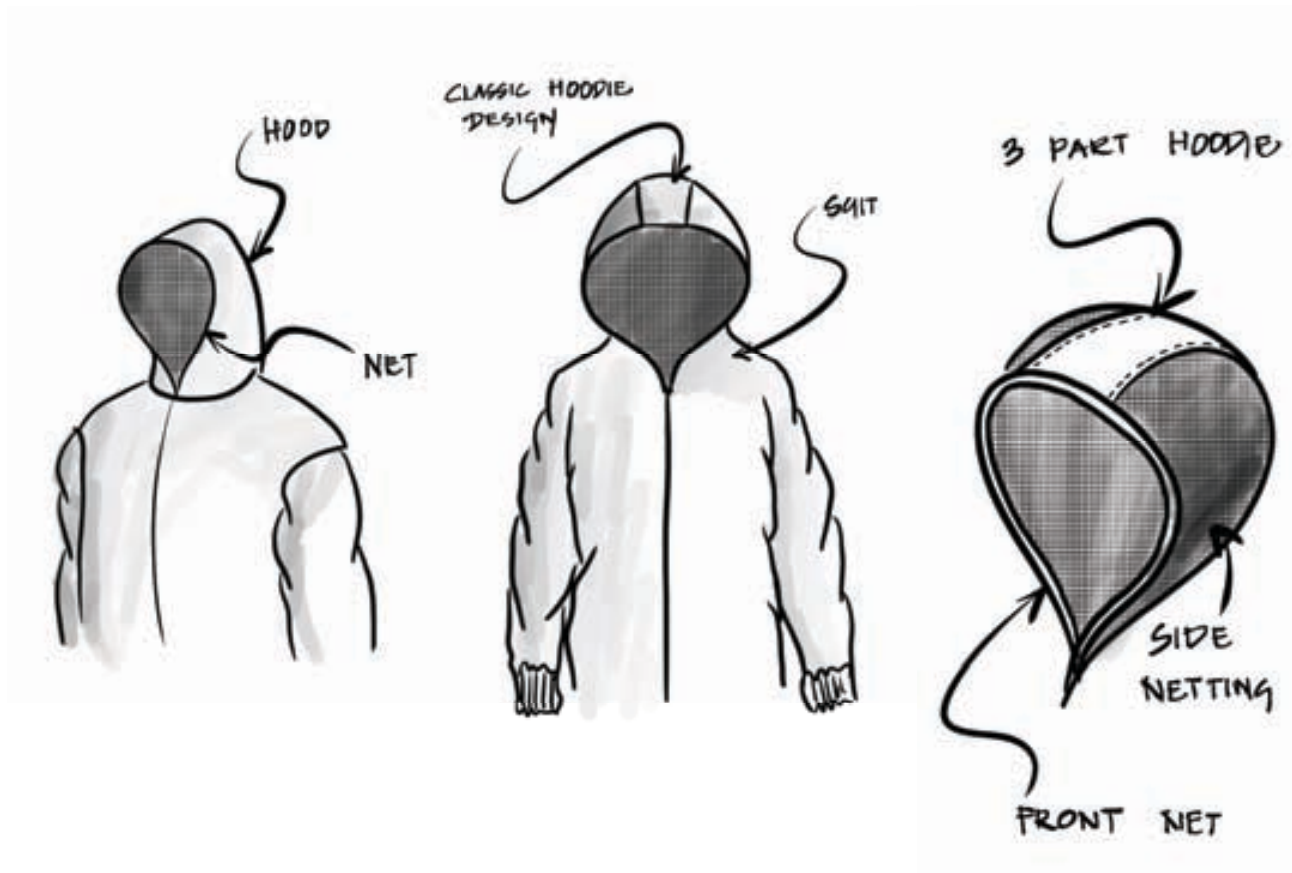
IDEATIONS

HEAD VEIL



IDEATIONS

HEAD VEIL



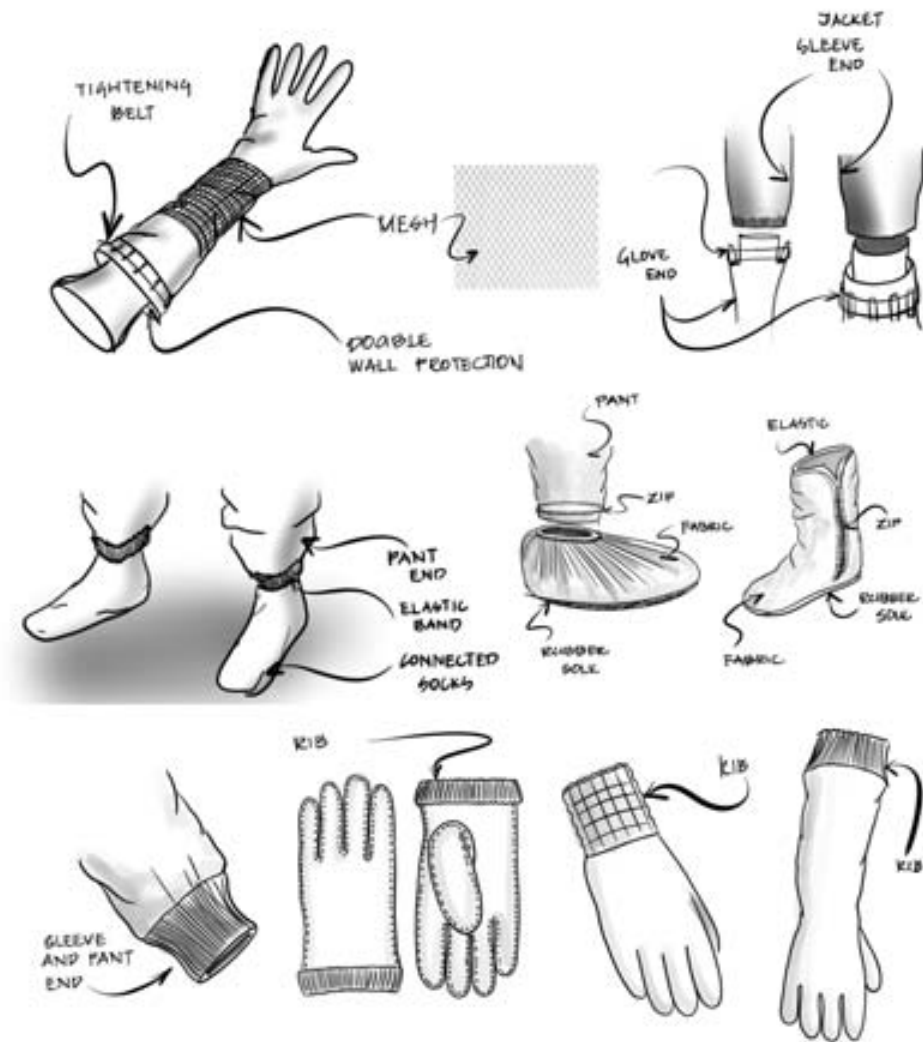
IDEATIONS

HEAD VEIL



IDEATIONS

GLOVES AND SOCKS



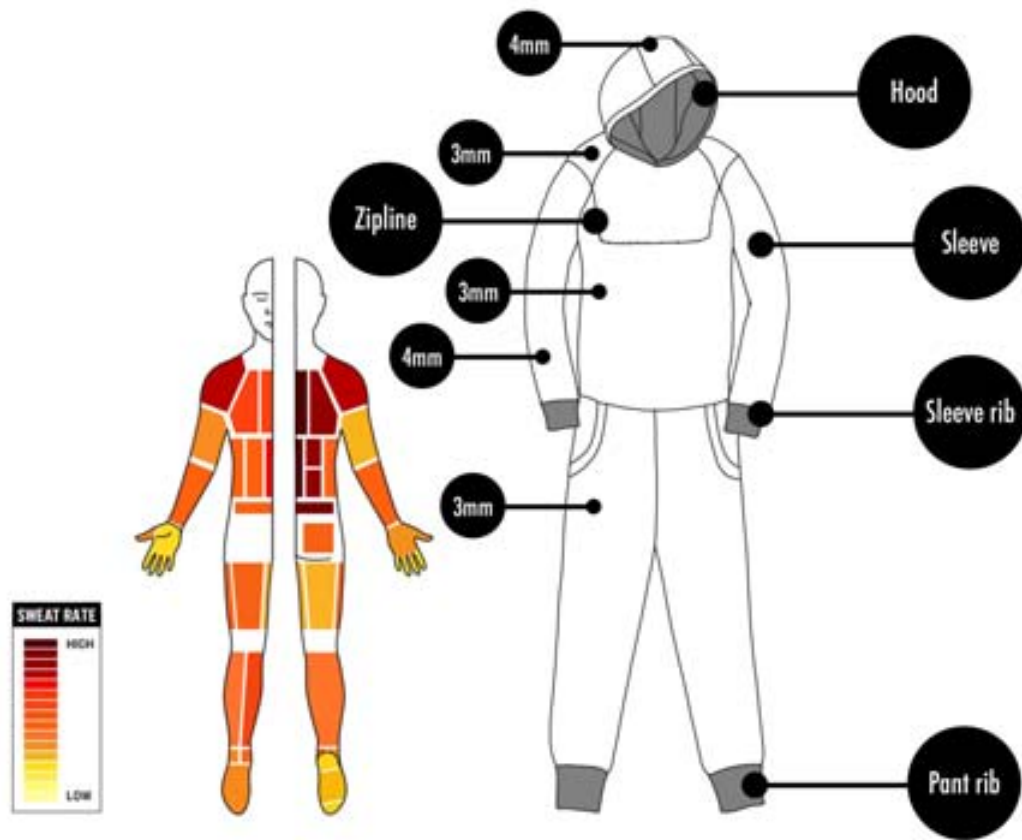
IDEATIONS

GLOVES, SLEEVES AND SOCKS

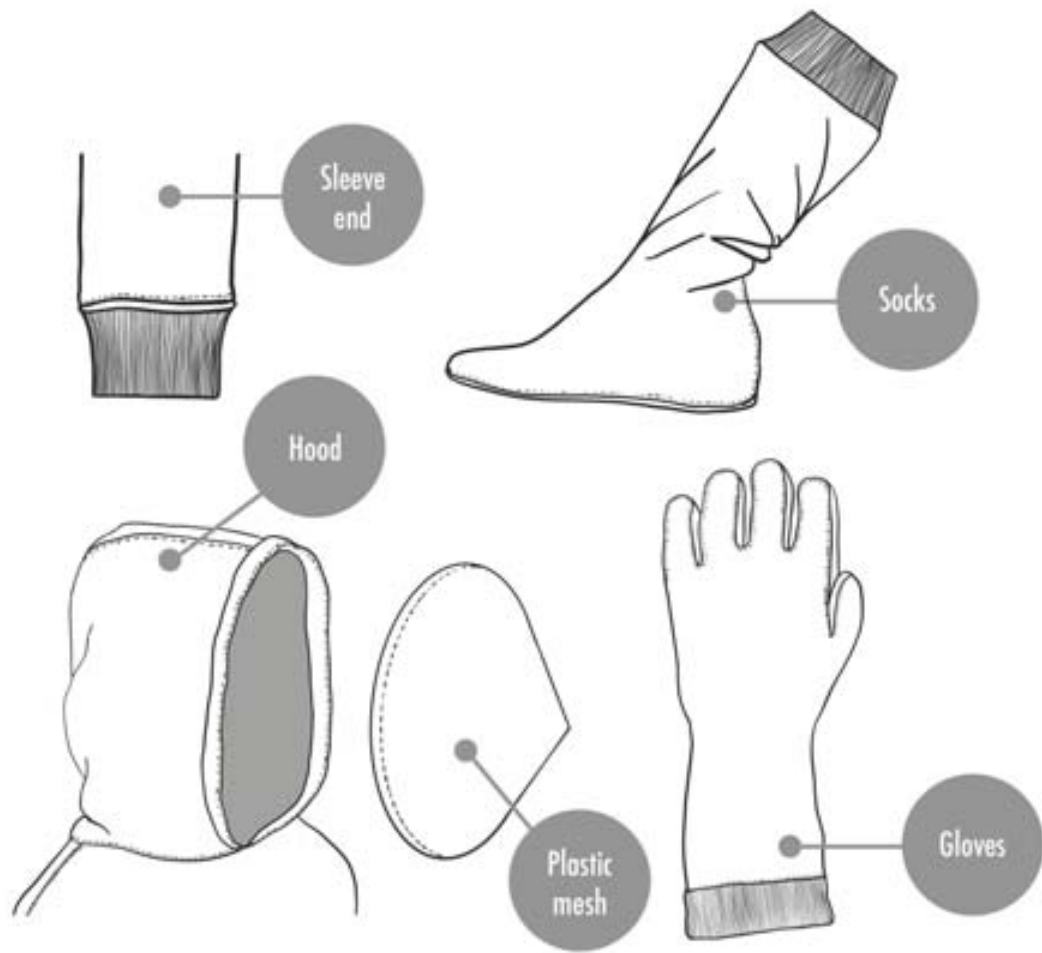




FINAL SUIT



FINAL SUIT



Part	Garment	Small (5'5")	Medium (5'7")	Large (5'9")
Upper	Chest circumference	36"	40"	44"
	Wrist	7.5"	8"	8.5"
	Waist	30"	34"	38"
	Shirt Length	27"	29"	31"
	Neck	15"	15.5"	16"
	Shoulder	16.75"	17.25"	17.75"
	Sleeve length	22"	24"	26"
	Shoulder to waist	18.5"	19.5"	20.5"
Lower	Hip	38"	42"	46"
	Crotch depth	10.5"	12.5"	14.5"
	Pant length (waist to heel)	40"	42"	44"
	Waist to knee	18"	19"	20"

Gloves	Wrist	8"
	Forearm	9"
	Wrist to Forearm	8"
	Index to Wrist	7"
	Middle to Wrist	7.5"
	Little to Wrist	5.5"
	Length of Thumb	3.25"
	Palm length	4"
	Palm width	4"

Head Veil	Forehead	22"
	Head to Chin	7.5"
	Neck	15.5"
	Ear to Ear	13"

Foot	Calf	11"
	Ankle	9.5"
	Calf to Heel	8"
	Calf to Ankle	6"
	Heel to Big toe	9.5"
	Foot Width	5.5"

FINAL SUIT

MANUFACTURING PROCESS



FINAL SUIT



FINAL SUIT



FINAL SUIT



FINAL SUIT



FINAL SUIT



FINAL SUIT



Existing Suit - ₹2200

- Material Cost - ₹160/m
- Fabric needed - 6m² (₹1000)
- Stitching cost - ₹ 1200

Single Prototype- ₹1480*

- Material cost - ₹450/kg (₹ 160/m)
- Fabric needed - 4m² (₹640)
- Zip, Velcro, Canvas and Rib - ₹90
- Stitching cost - ₹750

Cost cut by 33%

Mass manufacturing - ₹940 (100 suits)*

- Material cost - ₹300/kg (₹ 100/m)
- Fabric needed - 4m² (₹400)
- Zip, Velcro, Canvas and Rib - ₹40
- Stitching cost - ₹400

Cost cut by 37%

FINAL SUIT

ADVANTAGES

	New	Existing
Ventilated & Less humid	55% - 50%	75% - 55%
Easy to wear and remove	1m 20 sec	4m 48sec
Less time to stitch	4 Hours	8-9 Hours
Less materials	4m	6m
Cost effective	₹1480 (₹ 940)	₹2200
Lightweight	.95 kg	2.3 kg
Flexibility	Flexible	Non flexible
Pure White	Pure white	Off white
Washable	-	-
Easily foldable	-	-

FINAL SUIT

ADVANTAGES

- ✓ More abrasion resistance
- ✓ Long lasting
- ✓ Less Wrinkles
- ✓ Less Shrinkage
- ✓ Dries Quickly

Everything has to be bought in bulk.

Needs intensive testing for a year.

- Durability.
- How long does it last?

Does not absorb sweat.

Gets dirty pretty quickly.



THANK YOU

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