

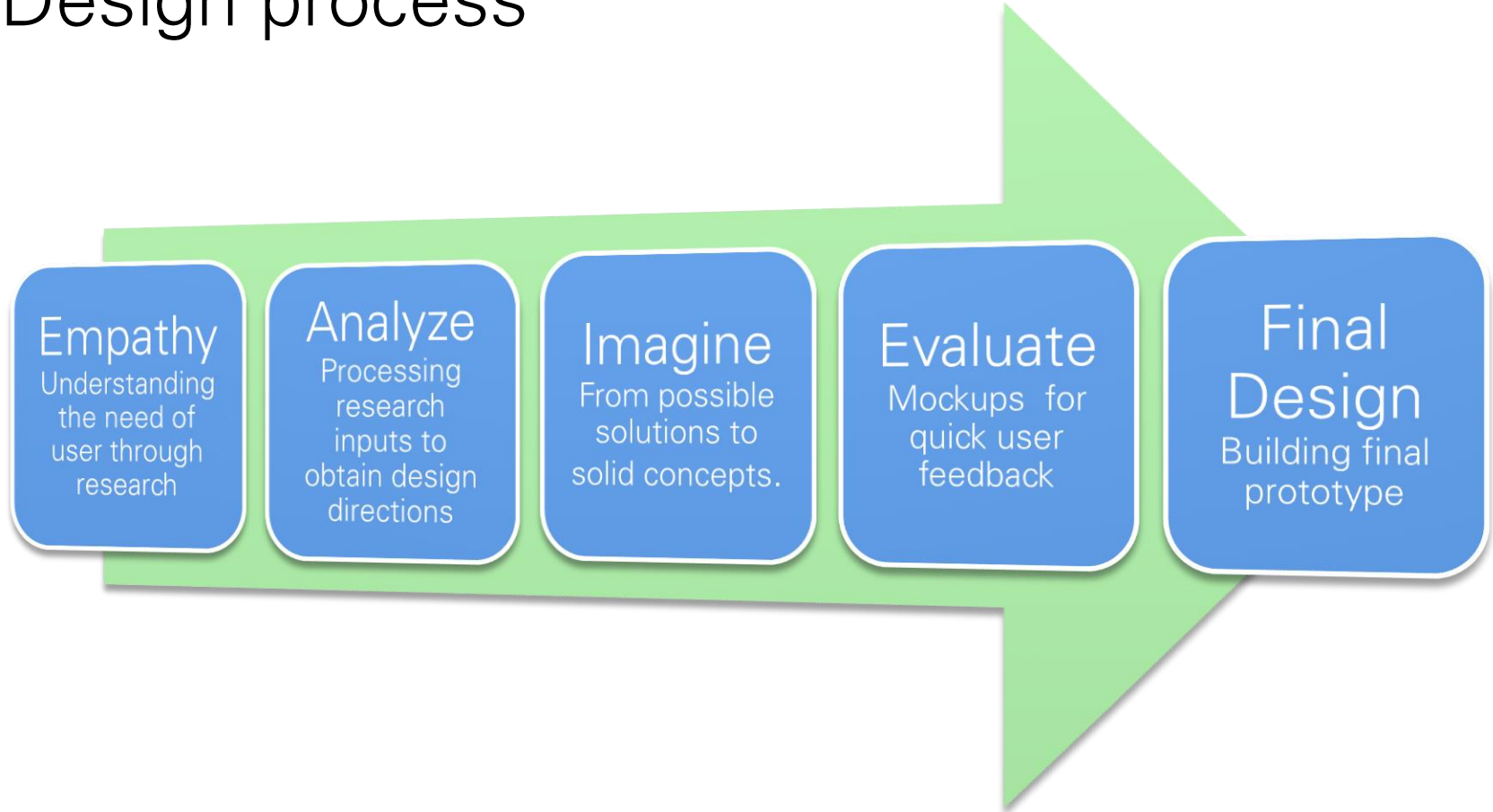
Self Sterilizing Surgical Instrument Sterilization Tray

Dinoj Joseph -166130002
Project Guide: Prof. V Bapat

Self Sterilizing Surgical Instrument Sterilization Tray

Why?

Design process



Primary research



Modern OT

Source: Hfm magazine:



OT in small hospitals

Surgical instrument classification

- Earle H. Spaulding



Semi-critical



Non Critical



Critical

Surgical instrument trays



Fixed type tray trolley



Floating type tray trolley

Surgical instrument trays



Fixed type tray trolley



Floating type tray trolley

Worried about side effects of antibiotics

Four more info- New superbug found in two patients here

They are likely to have
caught the bug locally;
more cases may

By SALMA K.
HEAL

superbug from India
killing news around the
no patients here early
anyone knew what they
- but was successfully
contained.
y of Health (MOH) told
es that the patients had in-
bacteria with the New Delhi
lactamase-1 (NDM-1) gene
month.

resistant bacteria when they showed
signs of illness besides the one they had
- for - an indication they might al-
with a superbug.
- from other

Both cases successfully
contained as experts
urge health officials to
track deadly bacteria

without any symptoms in Asian countries ranges
from 13.7 per cent to 91.7 per cent.
the prevalence is 31.4 per cent.
the Chinese and

of antibiotics, will create a more resistant strain of
the bacteria.

As such, it is advisable to confirm that
bacteria has been eradicated
test after the antibiotic

NDM-1 made the headlines after a
study published on Aug 11 in The Lancet
medical journal said the gene was detect-
ed in British patients in 2007, and ap-
peared to have originated from India. So
far, it has occurred mainly in two gut bac-
teria - Escherichia coli (E. coli) and Kleb-
sella pneumoniae.

The news triggered a global reaction as
NDM-1 is able to resist even the most
powerful class of antibiotics known as car-
bapenems. It has been reported in plac-
France, Ger-

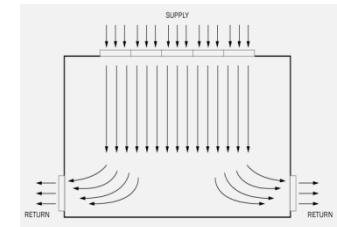
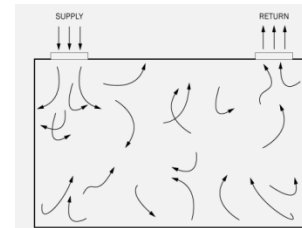
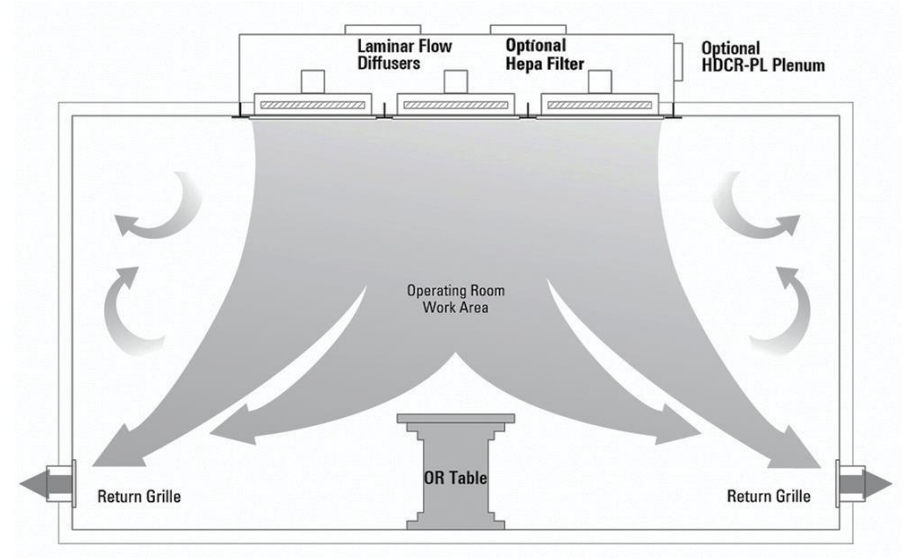
science
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health autho-
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The con-
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Drug-
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Sources of contamination in OT

- Poor scrubbing up, gowning and gloving.
- Movement into and out of OT
- Contamination from machines inside the OT
- From occupants by talking, nose, shedding of skin.
- Contamination through central air conditioning system.
- Laminar flow or other techniques doesn't reach the instrument table effectively.
- Instrument are set long before the surgery started.
- If instruments are dropped or touched.
- Bacteria culturing in live tissue or blood on the instruments.

Existing procedure to prevent OT contamination

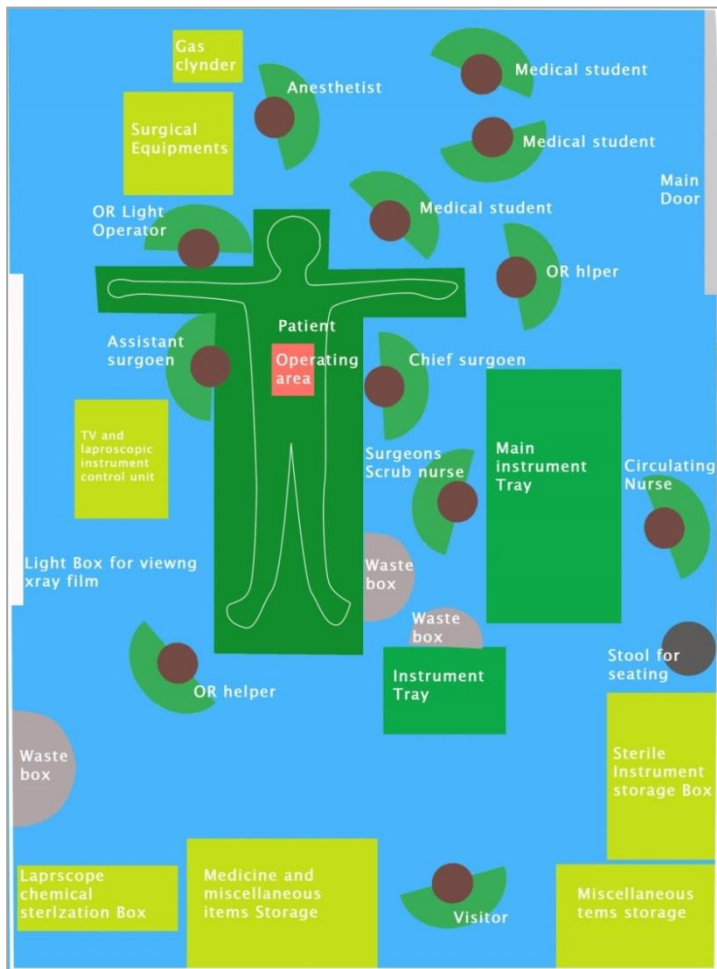
- Zoning
- Fumigation
- HEPA filter



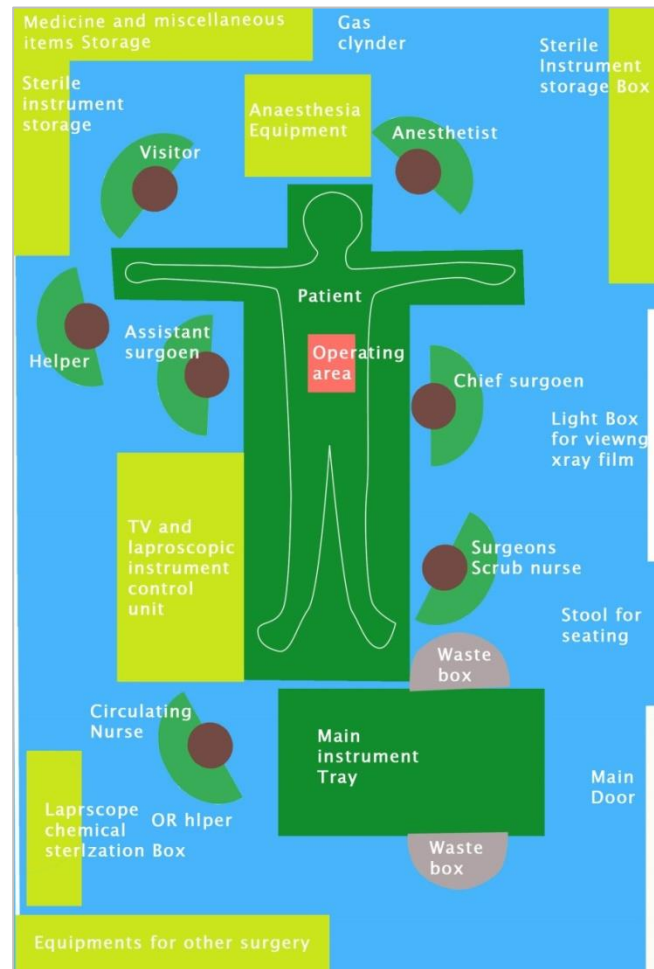
Source: ASHE

Secondary research

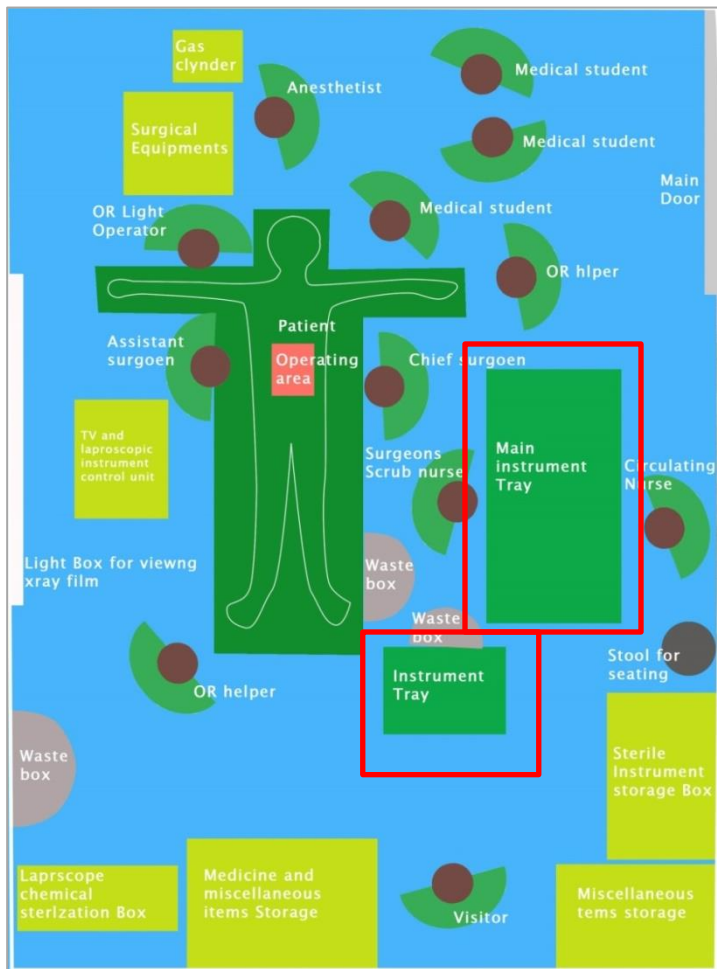
- 7 doctors (4surgens, 1dermatologist, 1dentist & a medical college director), & 3OT staff were interviewed.
- Visited two ENT OR
- Witnessed two Gastrointestinal surgeries



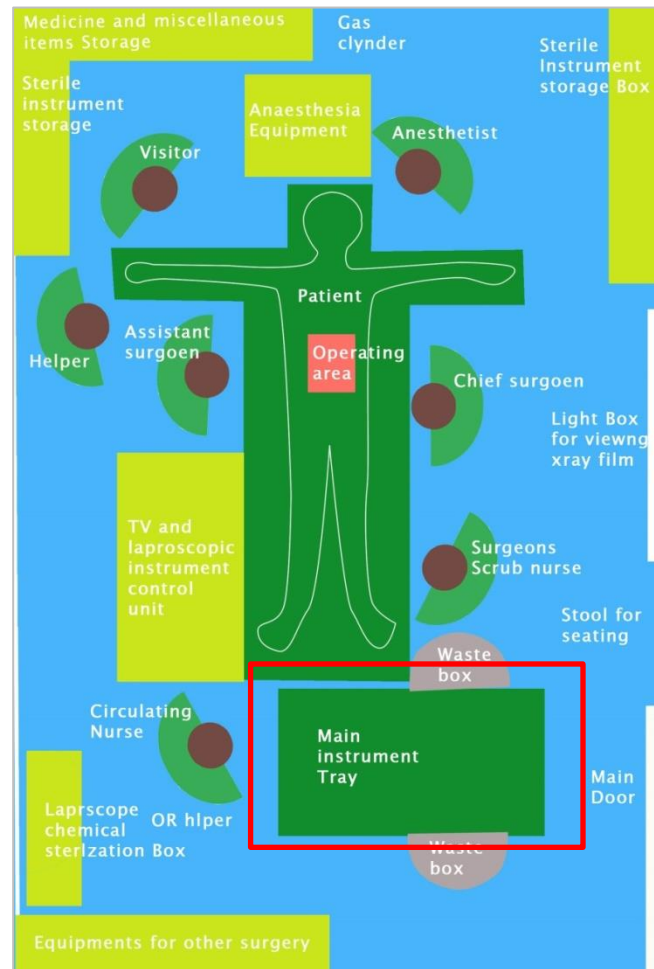
OT 1



OT 2

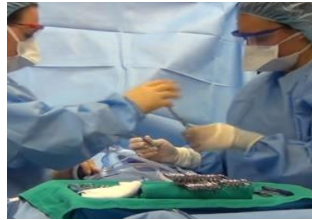
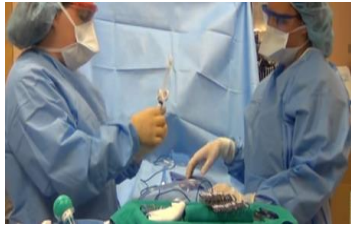


OT 1



OT 2

Micro motion analysis



Source: MrCPD Tech

Common laparoscopic instruments

Largest instrument dimension

- Length 60cm
- Breadth 12cm
- Width 3cm



Existing products & Market study

Existing products Market study



Air Flow Unit: Size: L 70 x W 60 cm; H 156-186 cm Power Supply: 230 VAC, 50 Hz for Europe, 115 VAC, 60 Hz for US

Power consumption: 280 W

Air Flow Data: 0,5-0,7 m/s, 400 m³/h

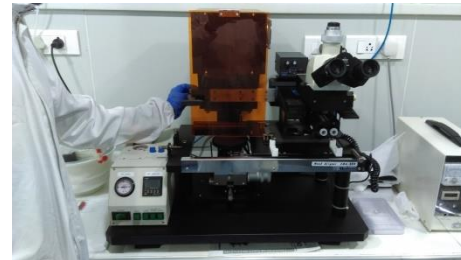
Working Temperature: +10° to +40°C (+ 50° to +104°F)

Humidity: 5-80% (non condensing)

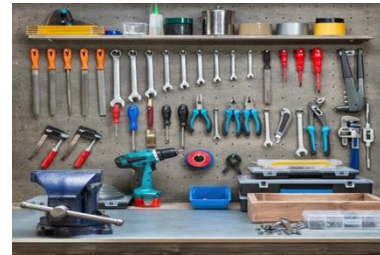
HEPA filter: Type: CAMFIL, High Efficiency Particles Filter; Filters 99,997% particles >0,3 µm

ISO class 5 equipment (ISO standard for clean room)

UV-C Applications



Material storage trolleys



Design Objective

'To design a surgical instrument tray which maintain sterility of surgical instruments through out the surgery'

Design Brief

- It should reduce the bio burden on the instrument.
- Should be ergonomic and easy to use.
- Instruments to be easily recognizable.
- If surgeon looks for the optimum tool the tools should be easily identified
- Either it will be a part of trolley or separately mountable
- Easy to install in exiting OT.
- Device should conform to class 5 clean room standard and Class 1

Target user

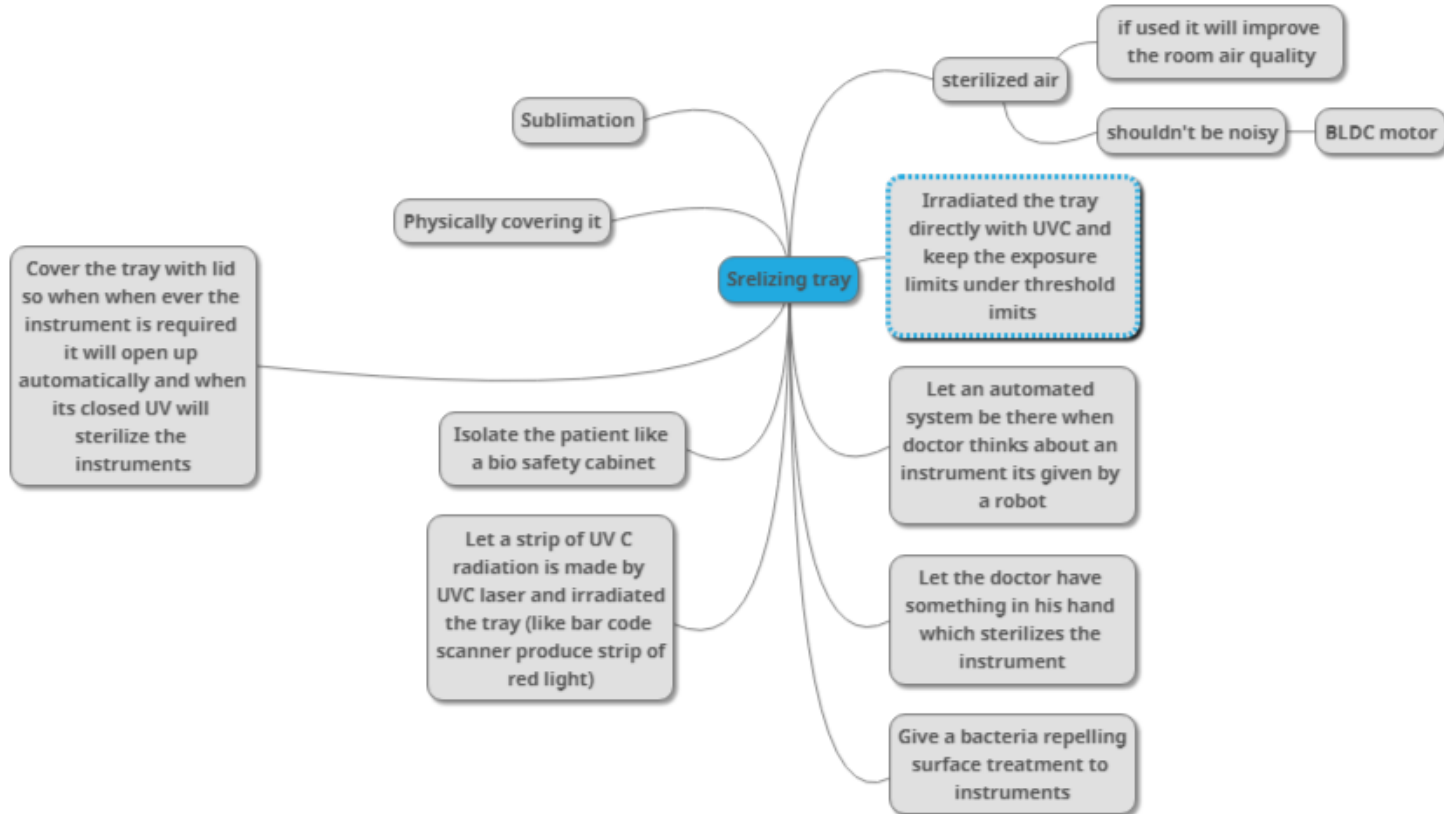
Primary user

- Scrub nurse (Nurse who assist the surgeon during the surgery)
- Surgeon

Secondary user

- Circulating nurse (The nurse who gives provides the instruments to the scrub nurse during surgery)
- Other OT staff(the one who cleans and disinfects the OT)

Mind map



Mood board

Stability



Trust

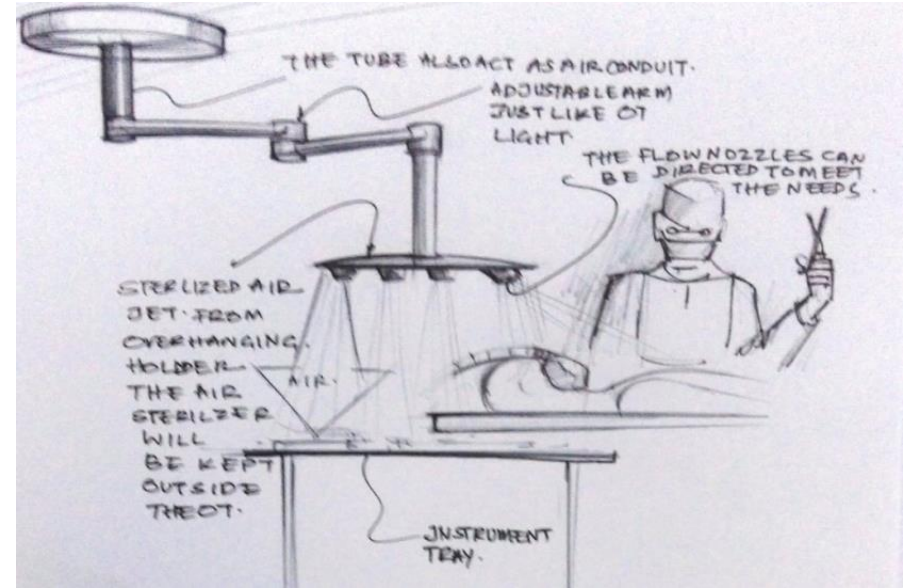
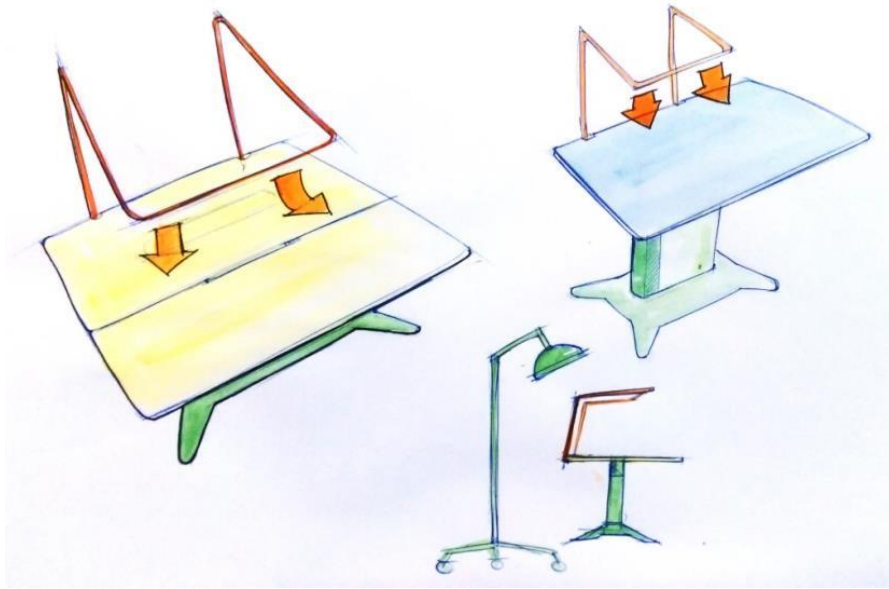


Authority

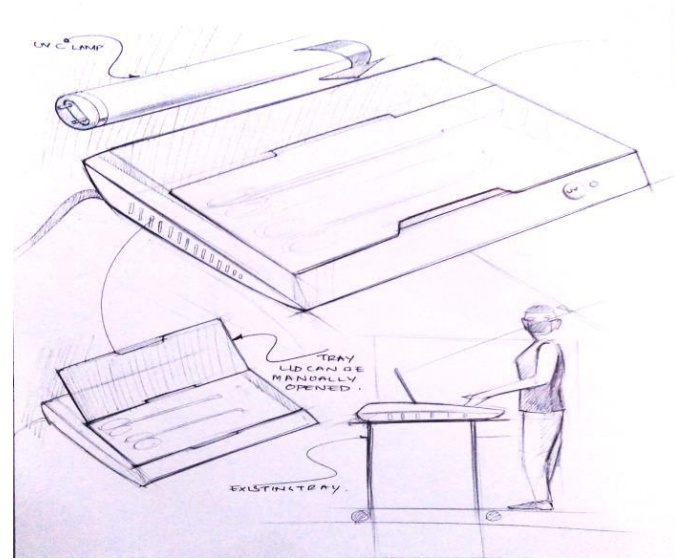
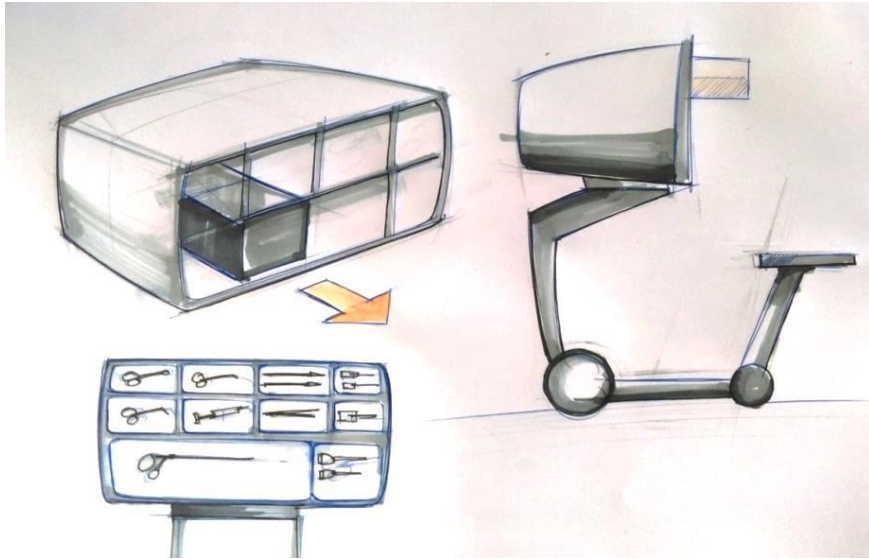
Tranquility

Ideation

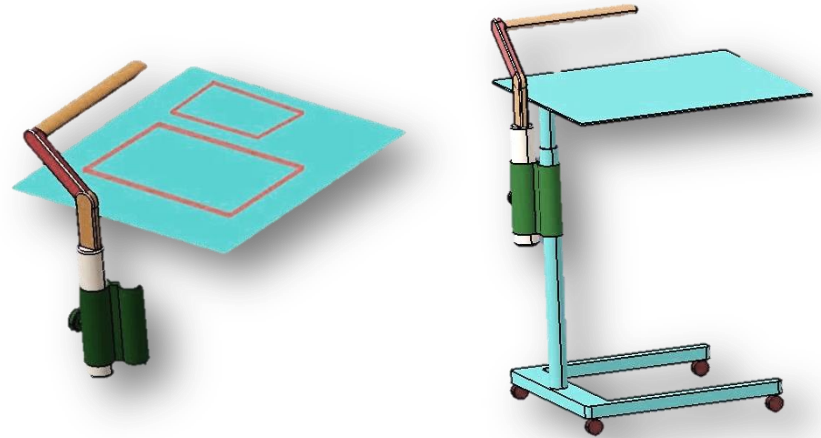
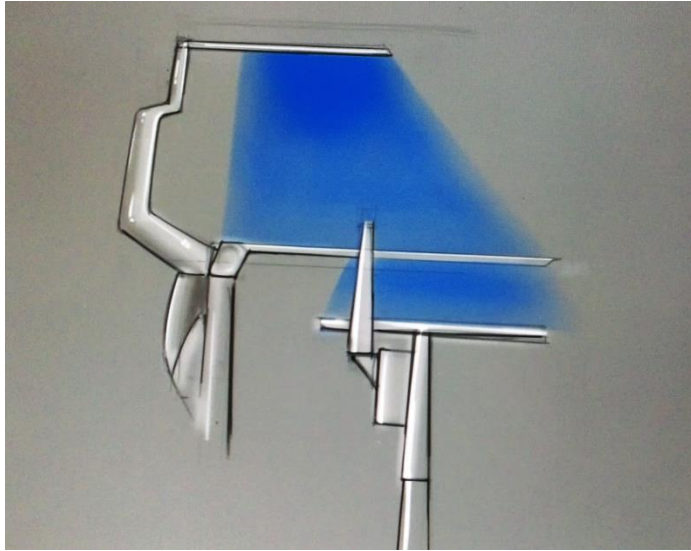
1. Keeping the instruments in a stream of sterilized air.



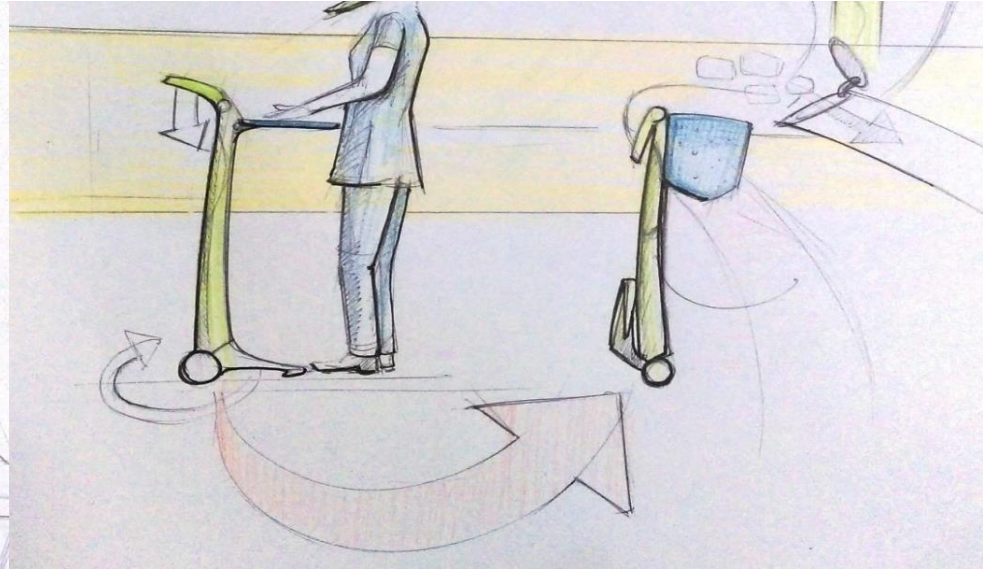
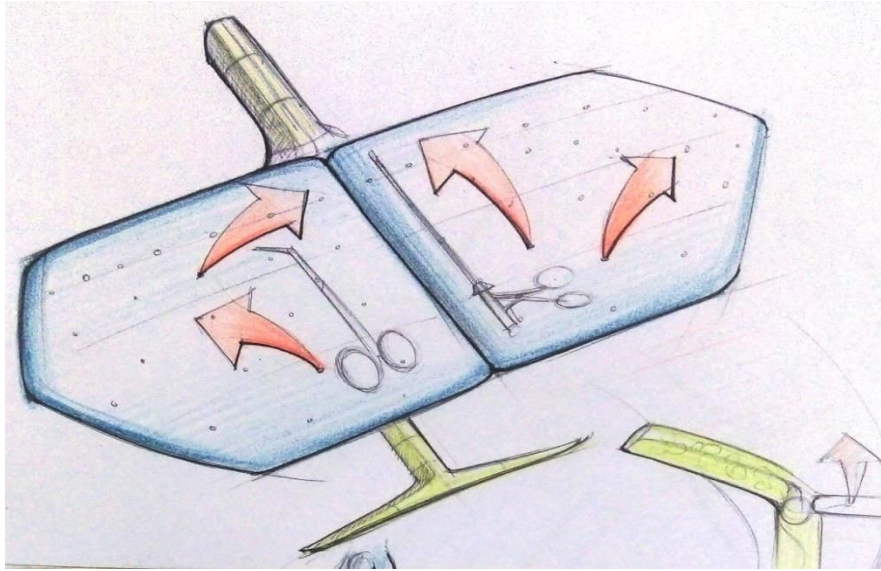
2. Instruments kept in a retractable tray and irradiated with UV-C radiation



5. Directly irradiating the instrument table by UV-C radiation



6. Keeping the instruments in sterilized chemical vapor

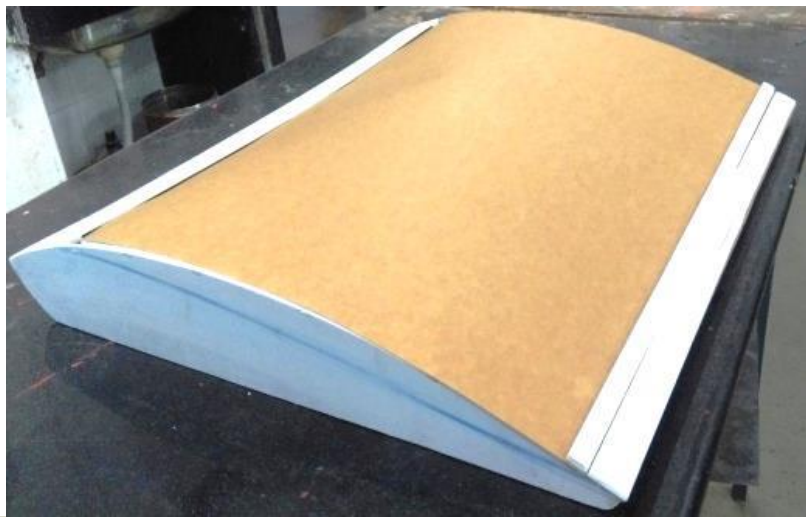


Concepts

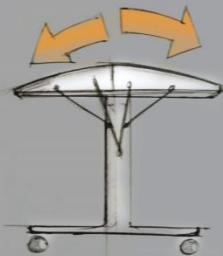
Concept 1

- Automatic lid retraction
- UV switched on when lid is closed

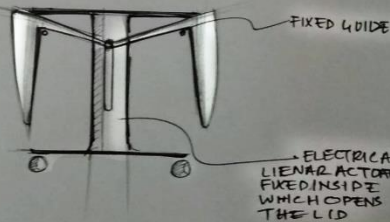
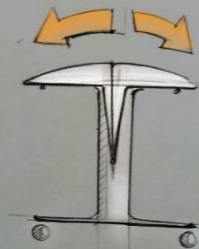
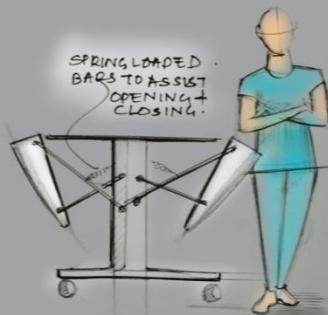




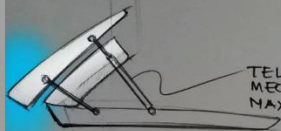
PEDEL OPERATED.
LID OPENING.
MECHANISM.
LIKE WASTE BIN.



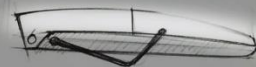
SPRING LOADED
BARS TO ASSIST
OPENING +
CLOSING.



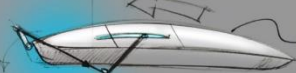
FOUR BAR
MECHANISM TO
OPEN THE LID.



TELESCOPIC
MECHANISM FOR
MAXIMUM LID OPENING.

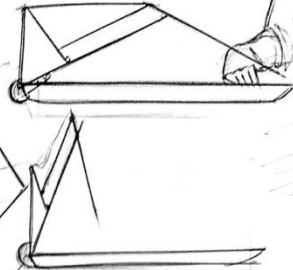
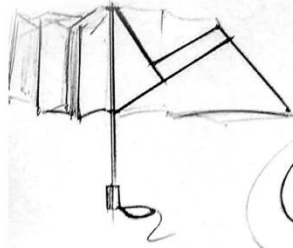


PNEUMATIC JACK
TYPE TELESCOPIC MECHANISM.
IF LIFTED IT'S MOVED BACK.

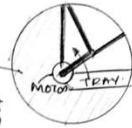


THE
FRONT
PANEL
SLIDES
IN THEN
OPENS UP.

UMBRELLA INSPIRED LID DESIGN

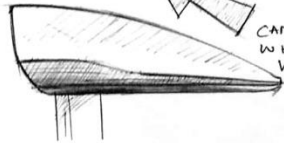
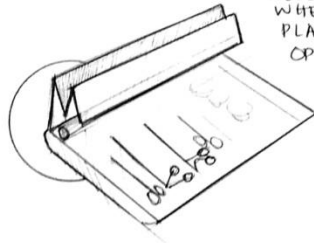
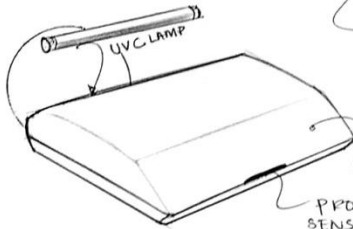


MOTOR ACTUATES BY 45° TO FOLD/OPEN THE CANOPY.

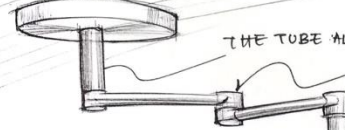


PROXIMITY SENSOR DETECTS WHEN HAND IS PLACED NEAR TO IT WHICH OPENS THE CANOPY.

UV RESIST FABRIC/ PLASTIC SHEET (LDPE)



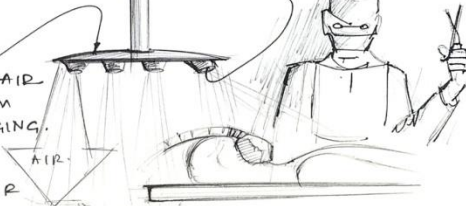
CANOPY LIFTS UP WHEN HAND IS WAVED OVER IT.



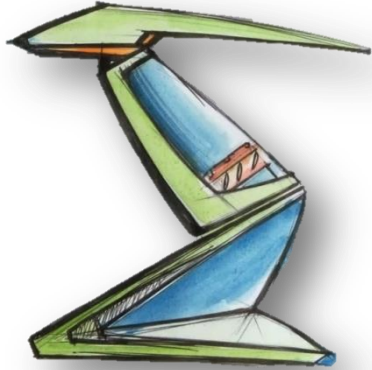
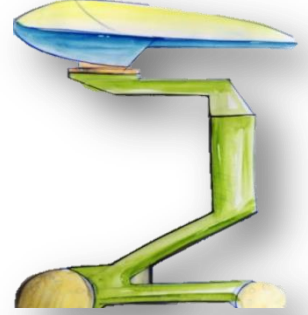
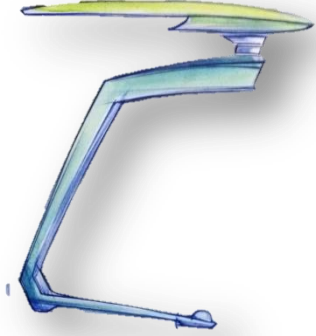
THE TUBE ALSO ACT AS AIR CONDUIT. ADJUSTABLE ARM JUST LIKE OT LIGHT.

THE FLOW NOZZLES CAN BE DIRECTED TO MEET THE NEEDS.

STERILIZED AIR JET FROM OVERHANGING HOLDER. THE AIR STERILIZER WILL BE KEPT OUTSIDE THE OT.



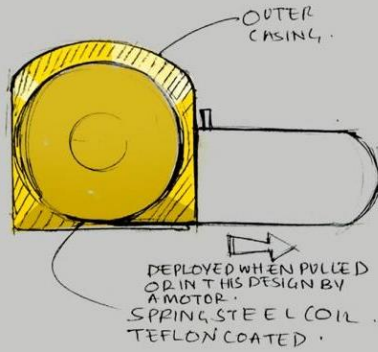
INSTRUMENT TRAY.



Concept 2

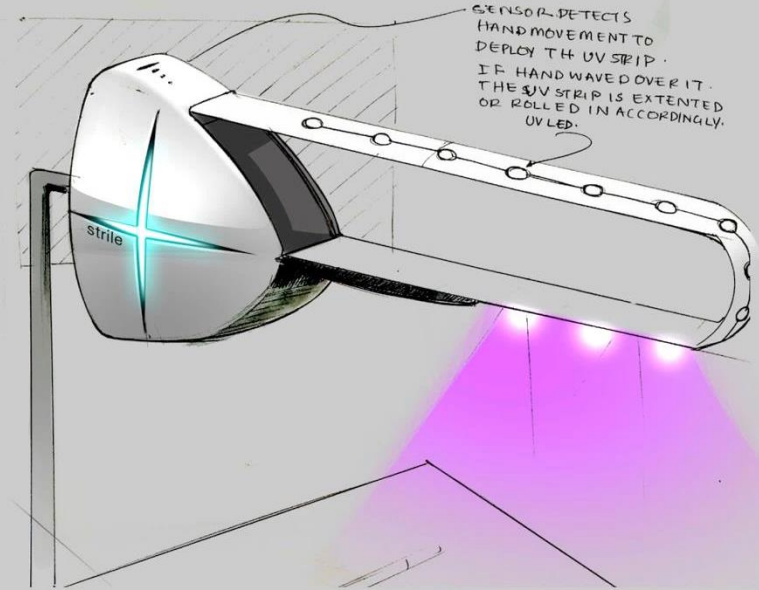
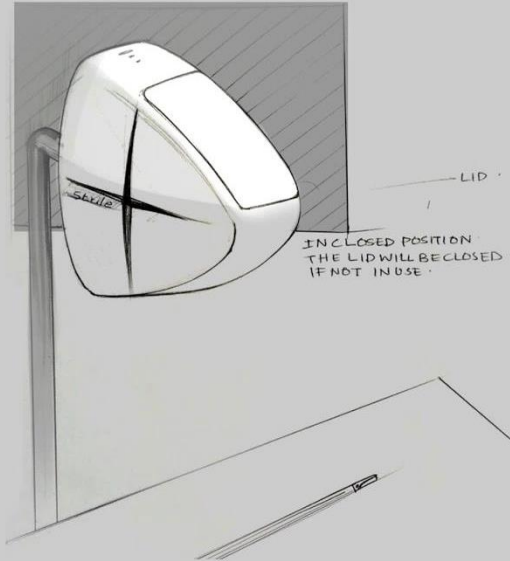
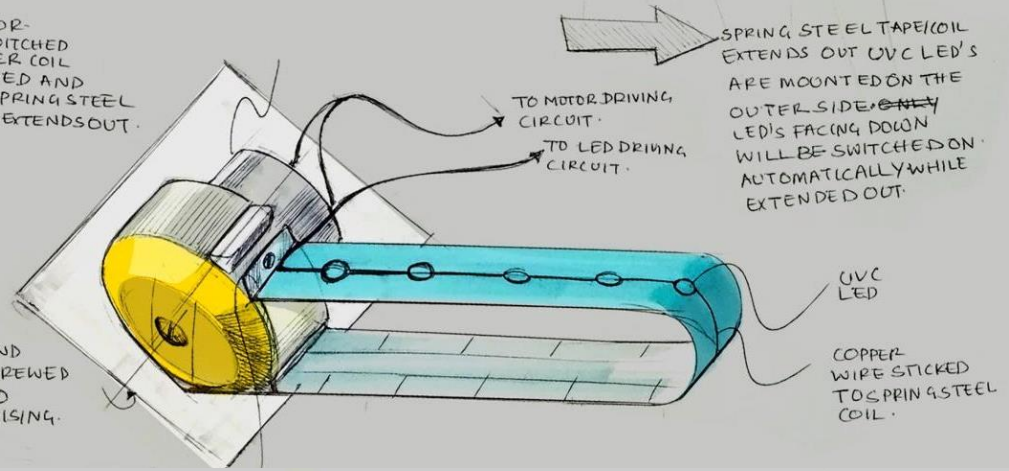
Tray is irradiated by UV-C





DC MOTOR - WHEN SWITCHED ON INNER COIL IS ROTATED AND THE SPRING STEEL COIL EXTENDS OUT.

END SCREWED TO CASING.

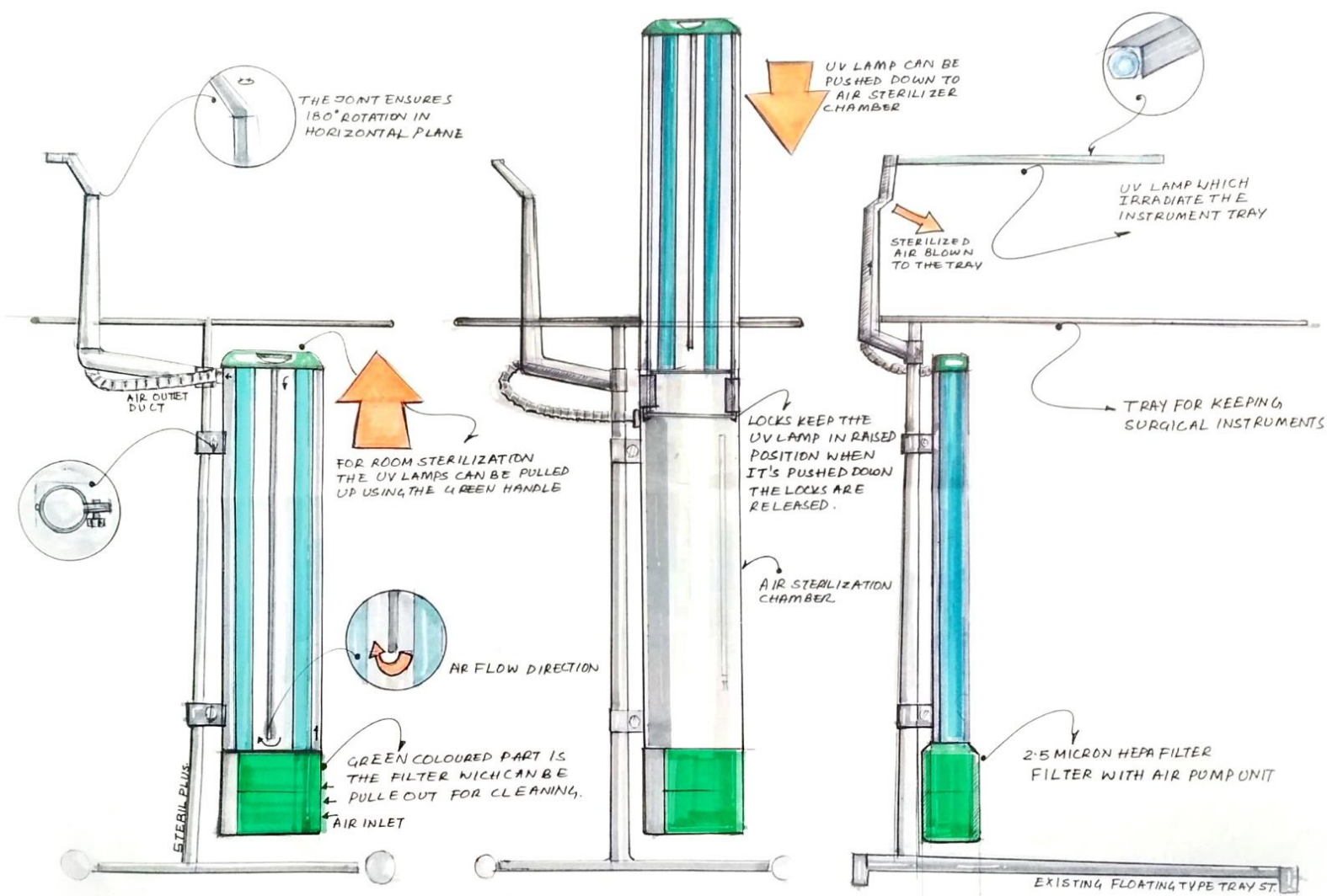




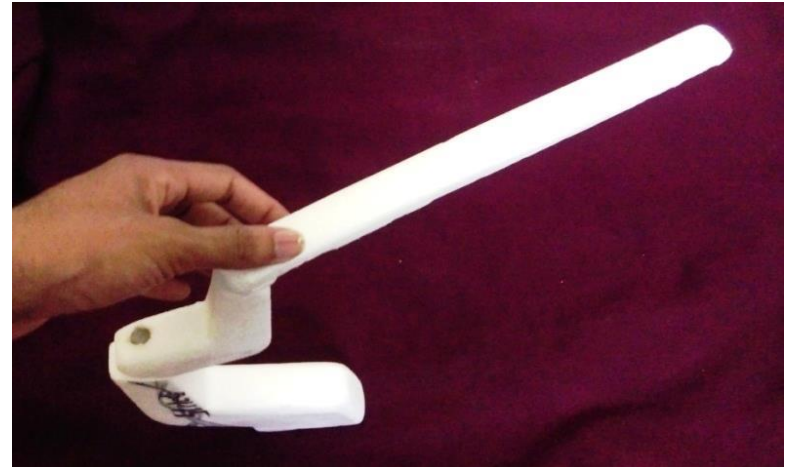
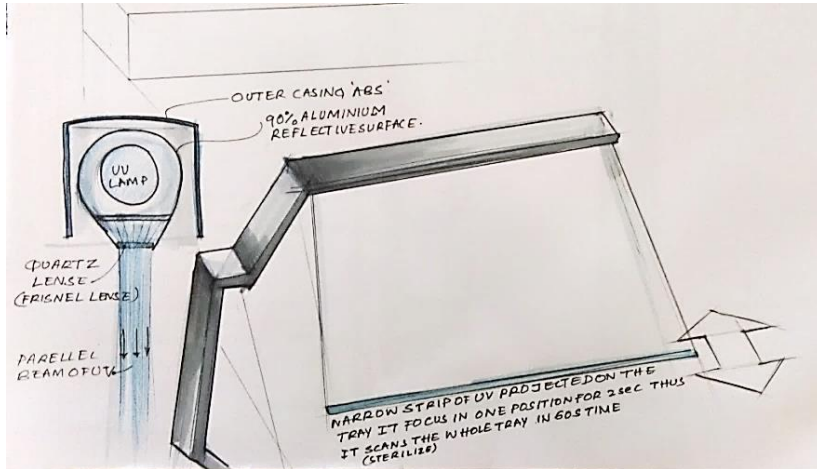
Concept 3

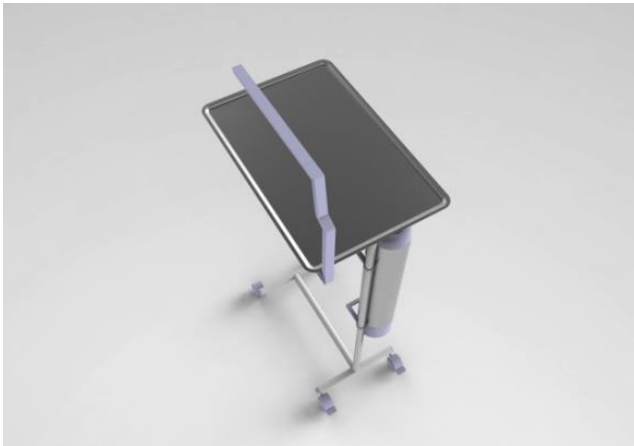
- Tray irradiated by UV C
- UV air sterilizer mounted beneath the tray keeps the instruments in a sterilized air atmosphere
- It also improves OR air quality

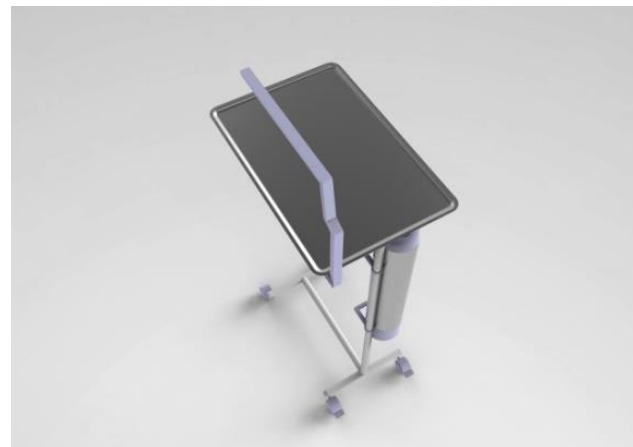
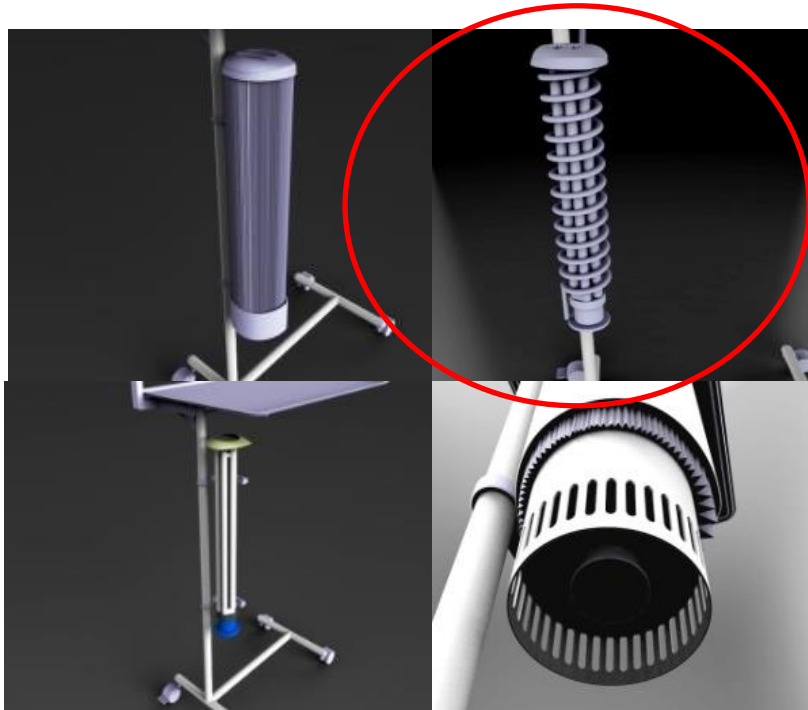




UV C strip which scans the tray







Concept Evaluation

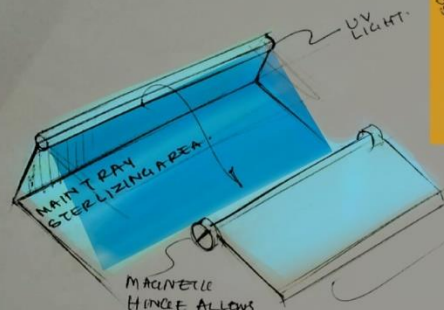
Concept No	Effectiveness of sterilization	Safety of occupants while equipment is in operation	Ease of operation	Cost effectiveness	Total marks
1	8	8	3	3	22
2	8	1	8	7	24
3	8	8	7	6	29

Marks are given out of 10 according to the expert feed back

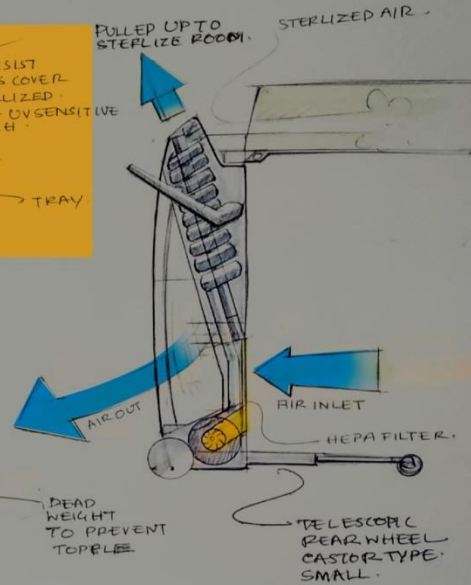
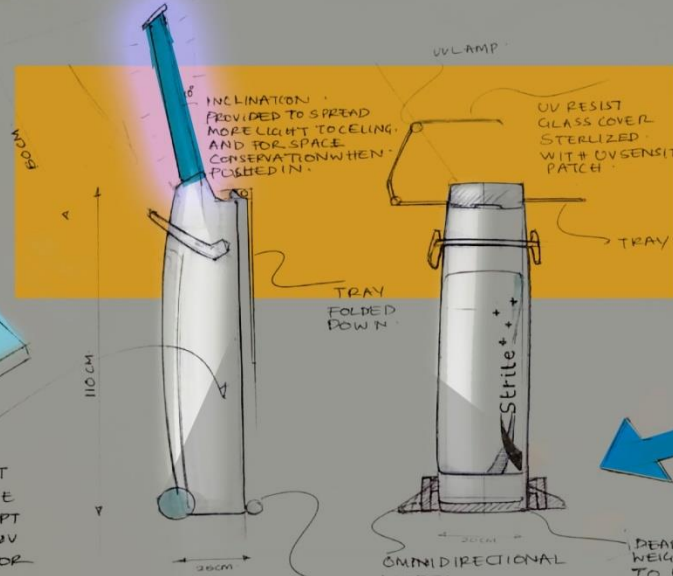
The third concept which uses UV with sterilized air is found most effective in terms of efficiency, usability and occupant safety.

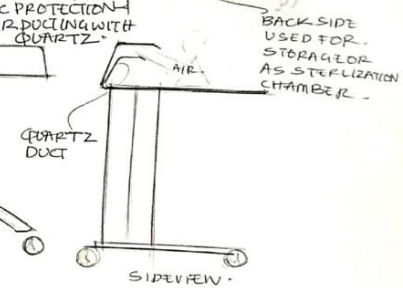
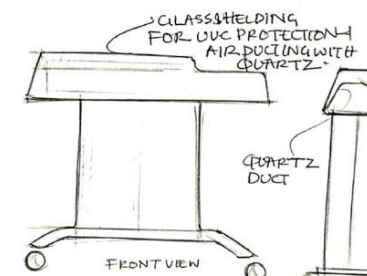
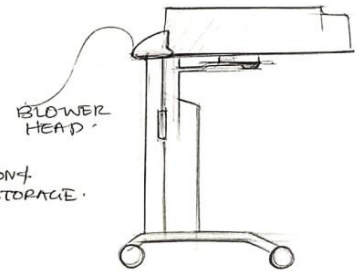
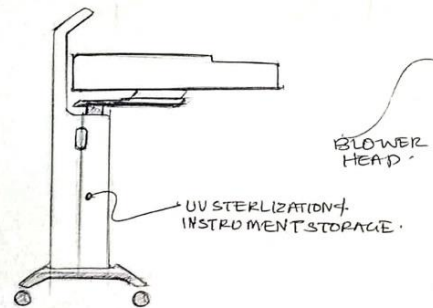
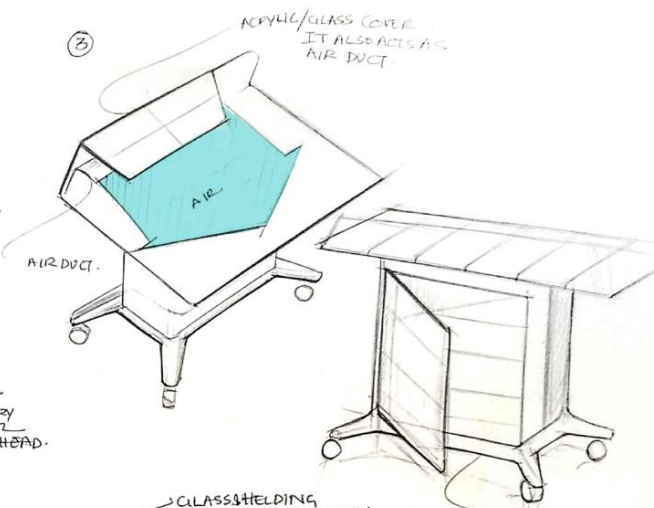
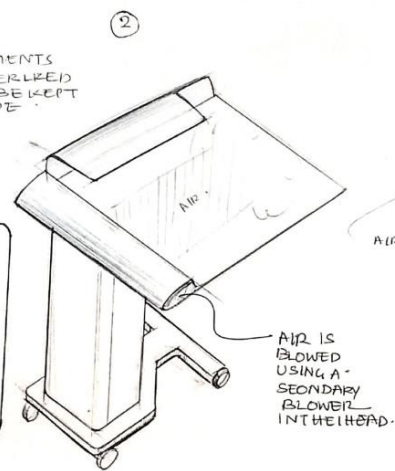
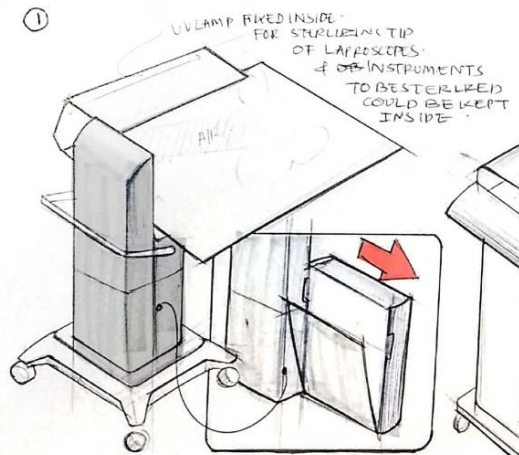
Final Design



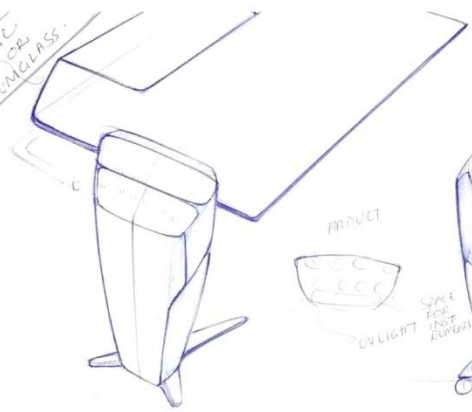


THE FRONT GLASS PLATE CAN BE KEPT INSIDE THE UV CHAMBER FOR STERILIZING.

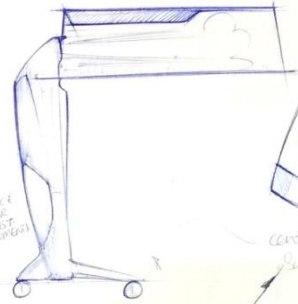




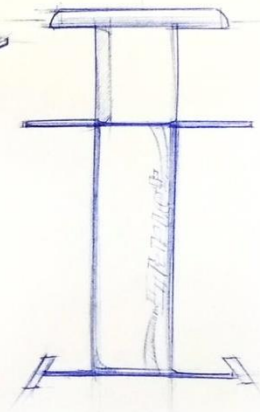
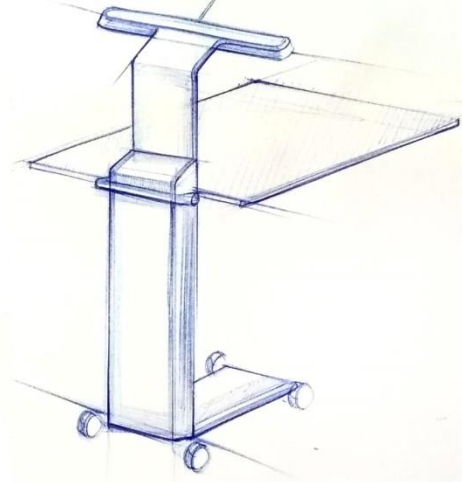
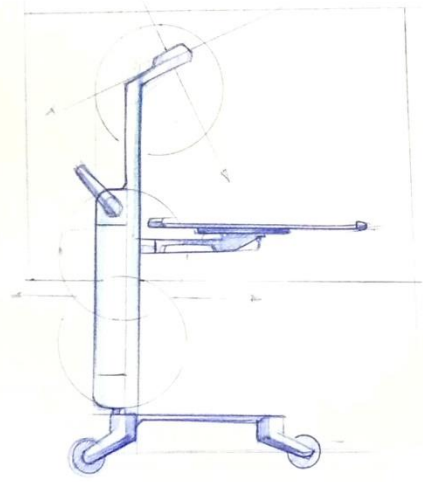
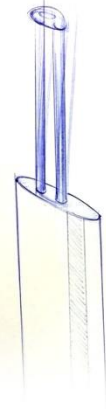
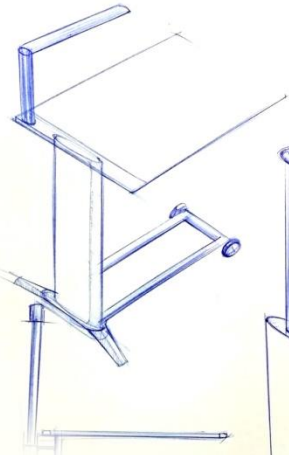
WHEEL
MUSCLE GLASS

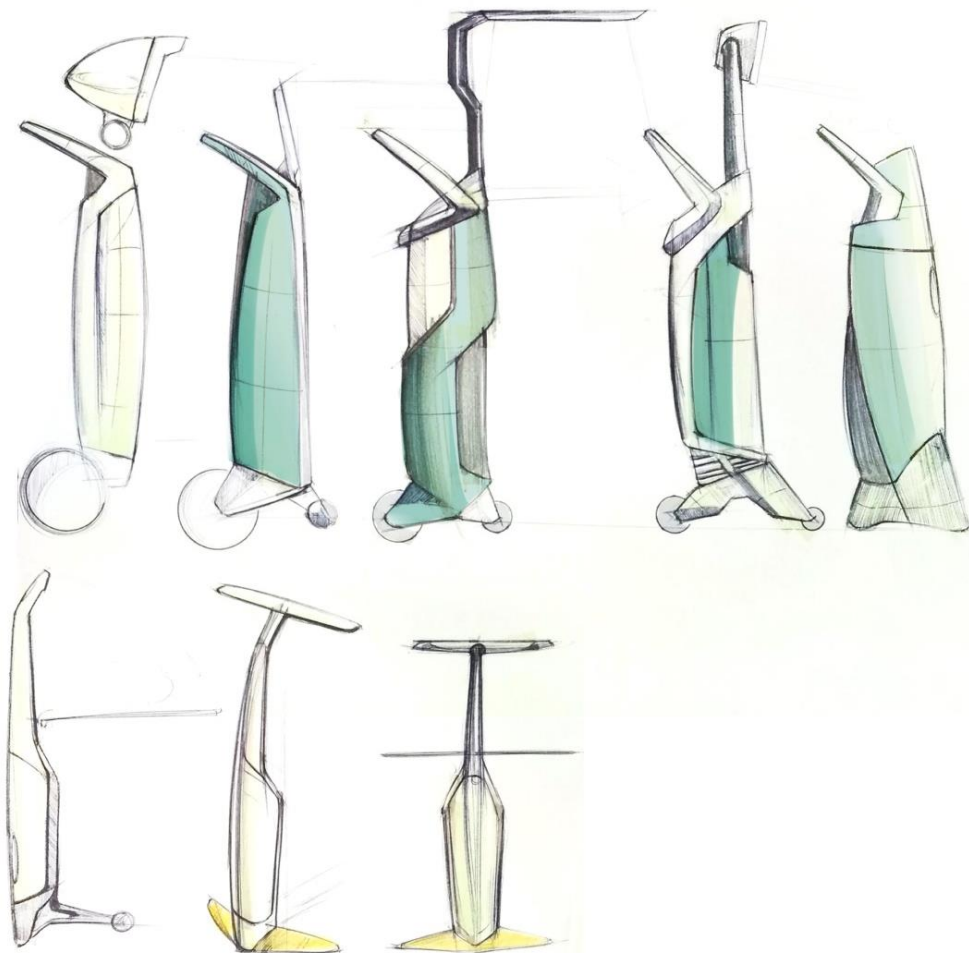
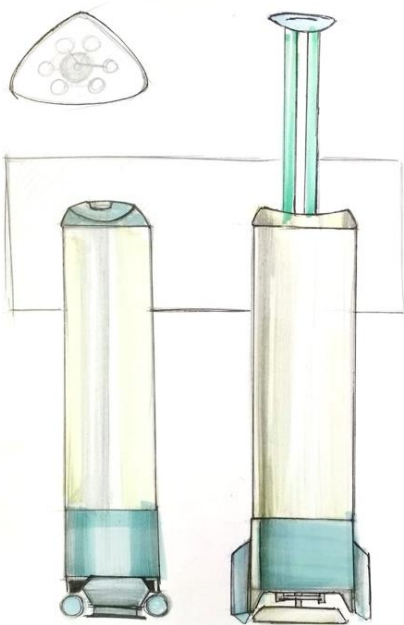


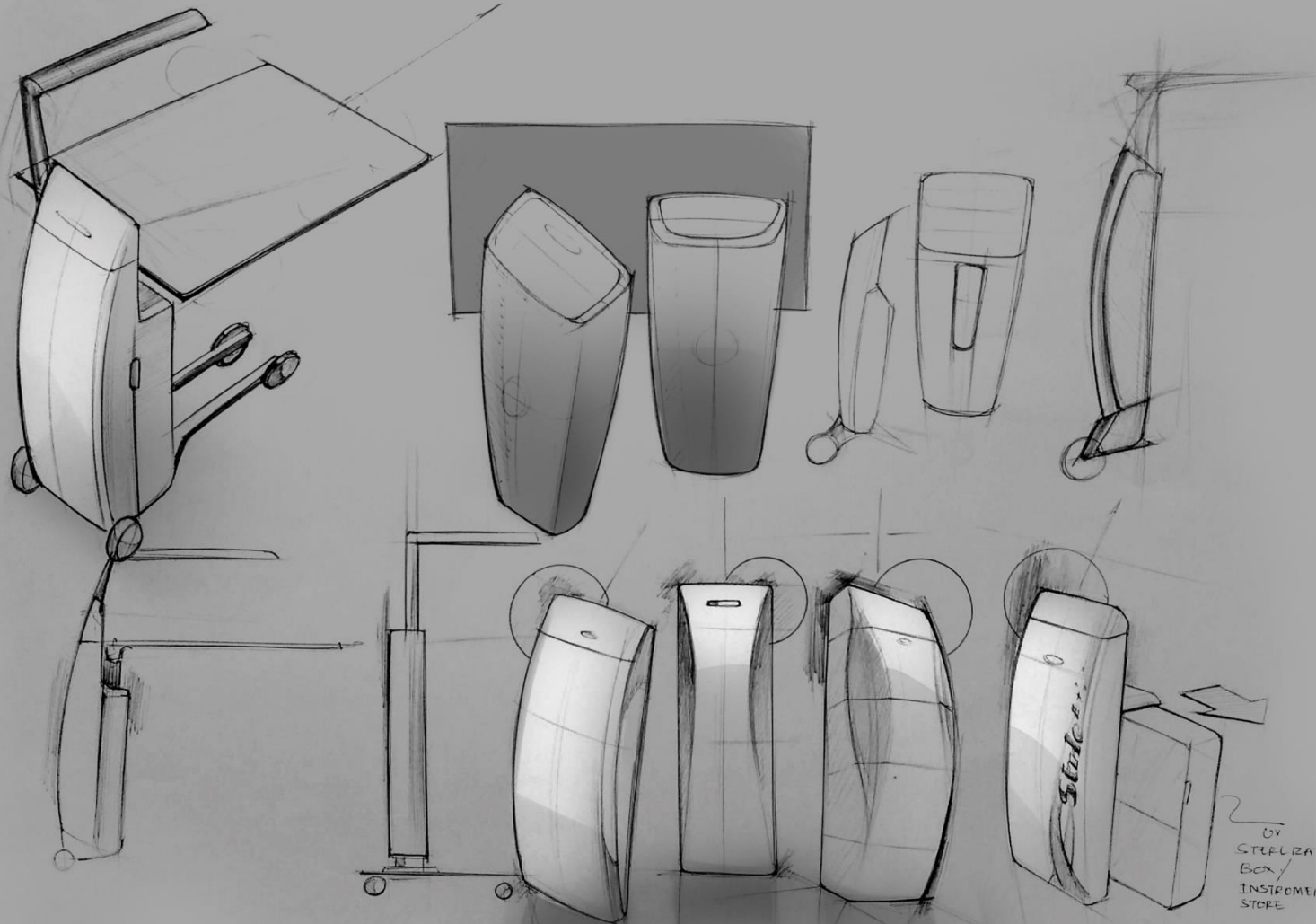
PRODUCT
SPACE FOR
HANDS
LIGHT

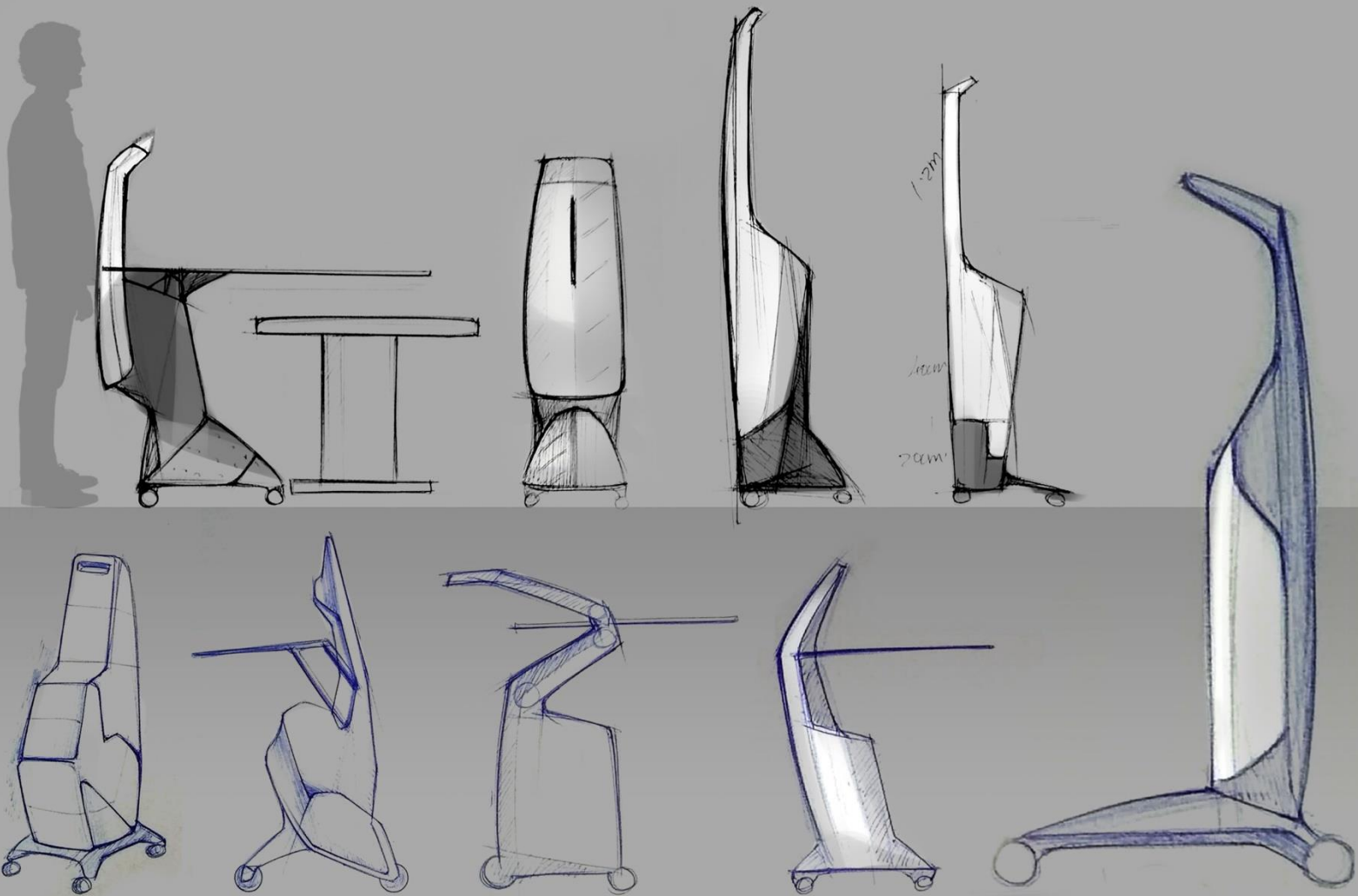


central Base, Hand Bar, or
Suction Breathing

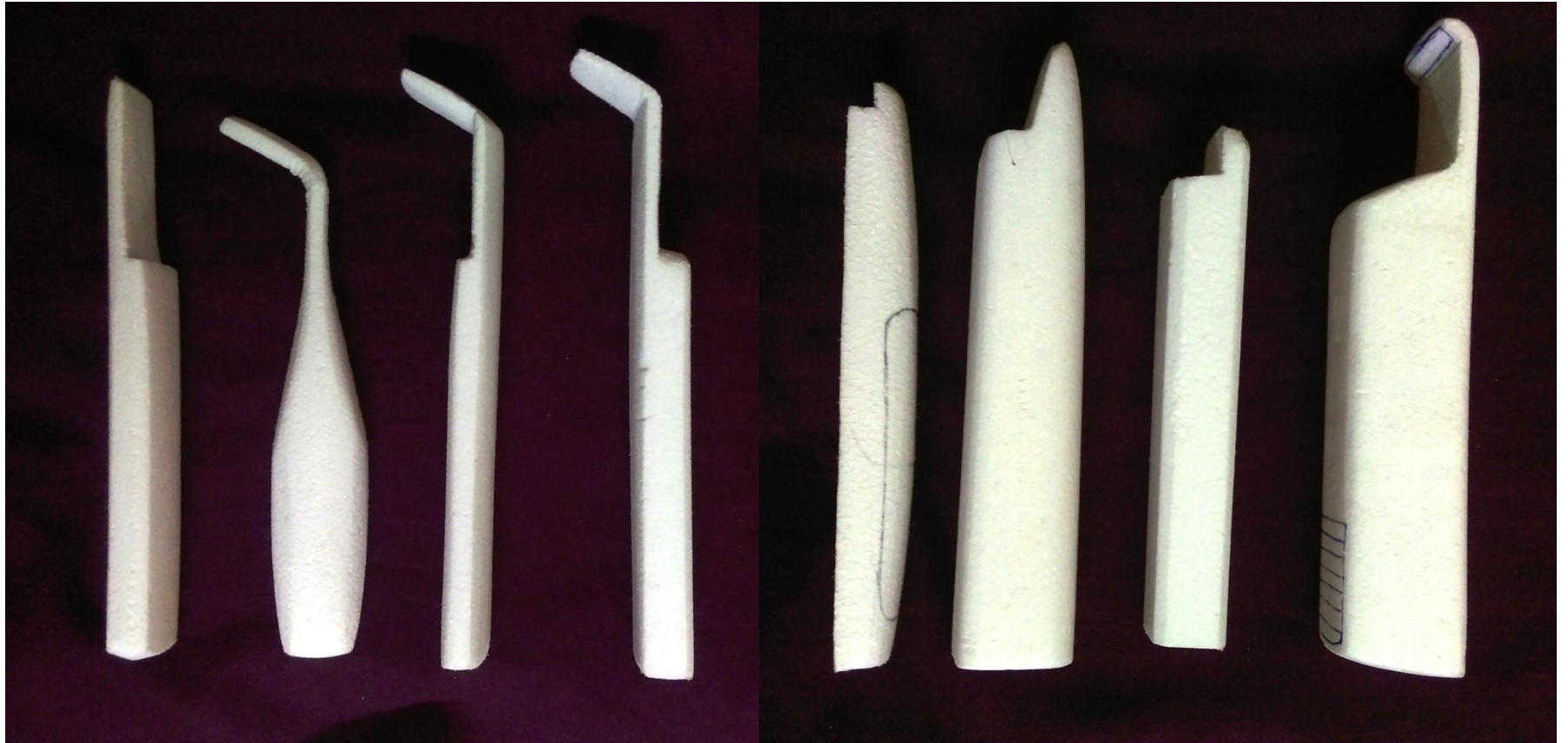


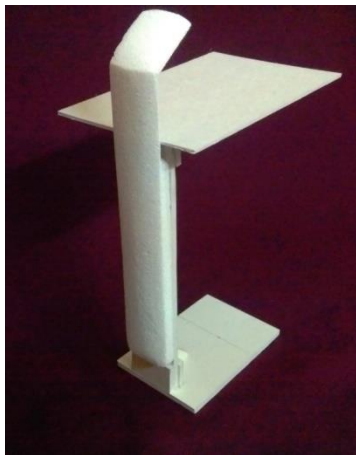




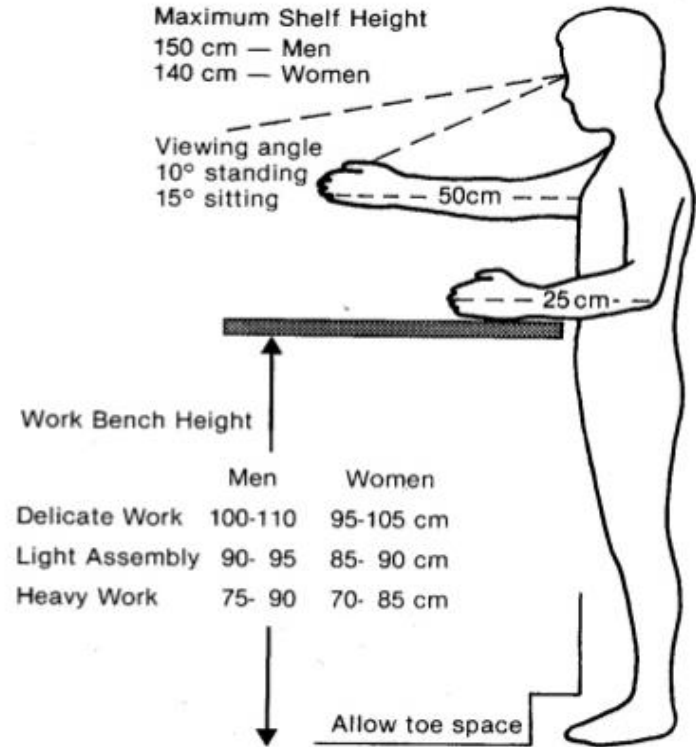


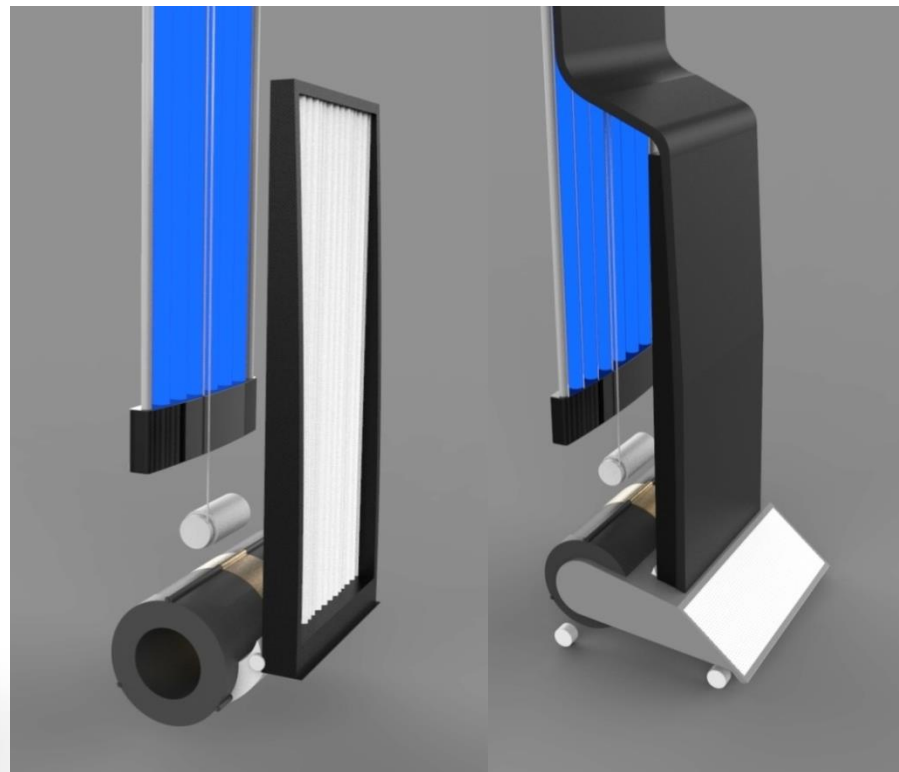
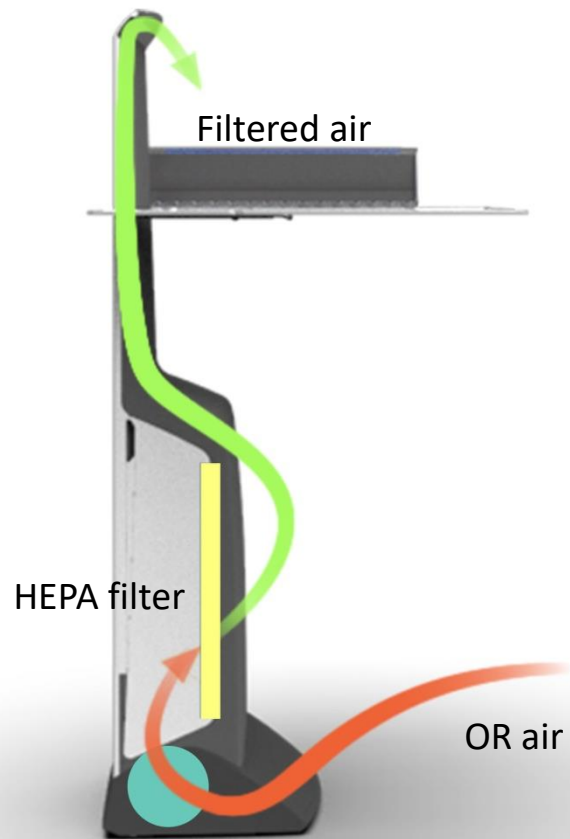
Form study



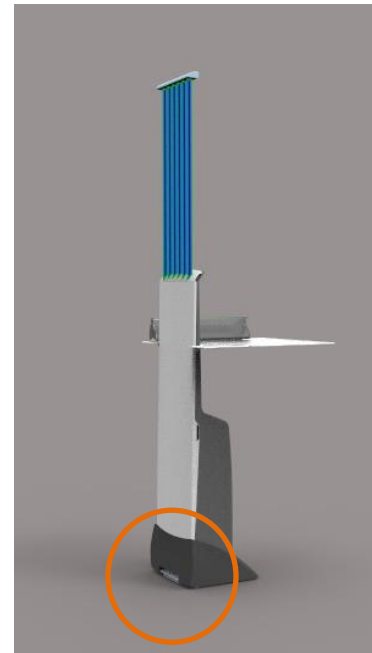
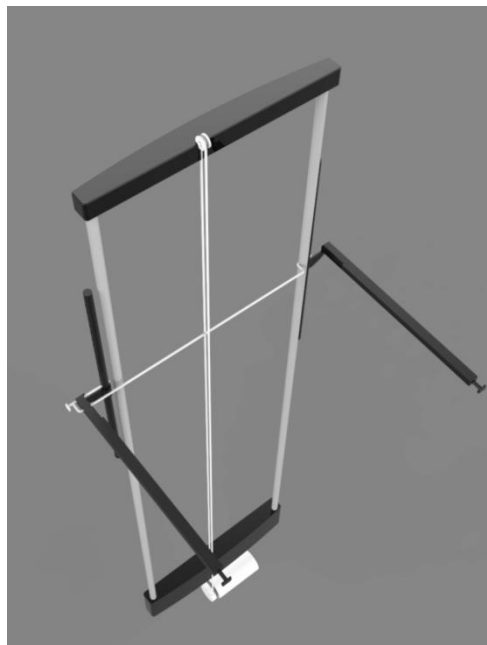


Ergonomic study





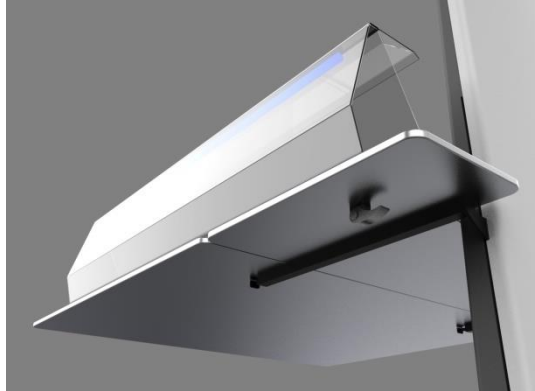
UV room disinfection unit



Transplant
sterilization Unit

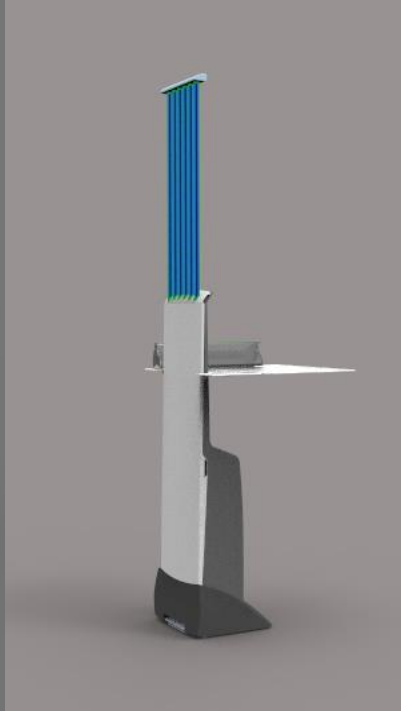


Quick clamp for
removing
instrument
sterilization Unit





UVC instrument
sterilization
chamber



UV room
disinfection



The device can
be folded for
storage

Folded UV
sterilization Unit

Manufacturing

- **Body**

ABS-injection moulding

PVC, HDPE-Extrusion blow moulding

- **UV C lamp**

TL-D 75W HO(Philips)

- **HEPA filter 0.2 micron**

- **BLDC Blower**









Remote control
operated

'Prevention is better than cure'

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