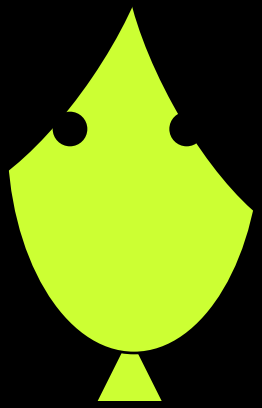


Design of a Mobile Computer Aided Learning bus

"Education messenger"

Industrial Design Project III

Utkarsh Gautam
05613806

Guided by-
Prof. B.K. Chakravarthy

Industrial Design Centre, IIT Bombay

Introduction

This project is aimed to be implemented in Bangalore for migrant labor's children. These children have no basic education, even the written knowledge of any one language (Kannada, Urdu, Hindi) is absent. Only few of the children have access to Govt./ NGO's run schools.But, their residence is not permanent.

The bus acts as a medium to impart them with the basic education like language, simple mathematics etc.It runs weekly to each site for 1-2hrs duration.

Azim Premji Foundation:

The Azim Premji Foundation is a not-for-profit organization operational since 2001 with a vision to "Significantly contribute to achieve quality universal education that facilitates a just, equitable and humane society".

Over 250 professionals and several volunteers are engaged in realizing this vision through the current engagement with over 16,000 schools and 45000 teachers in partnership with 17 Indian States.

The e-learning material is prepared and preloaded in the bus by APF.

The major stakeholder in this project is the builder/developer of the site who is also the employer of the parents of the disadvantaged children.

Project objective

- Increasing the interaction and comfort level of the children
- Reducing the maintenance of the bus
- Enhancing the visual appeal

Data collection

- Sites Visited :
  - Whitefield
  - MFAR const.
  - Jai Bhubaneshwariconst.
  - Bellandur
- Local School visit :Govt. school,SarjapurRd.
- Vendor meeting : S.M. Kannappa(Lalbagh)
- Video documentation and contextual enquiry
- Documentation of present bus –

  Dimensioning, Layout, Fixtures, Components (electric/ non-electric) including driver's cabin
- And the interaction between –bus to user, user to user
- Anthropometric dimensioning of children

Aim of study:

The target group in this project is the children of migrant labour, residing near the construction sites at Bangalore

Study was done to get acquainted with the present usage scenario and user aspirations based on the their living, activities, environment and daily routine.

The study is concerned for the children who may or may not attend the regular government run school.

Design Methodology

The following Design methodology was used for the project so that results are innovative and project brief can be met effectively -

- **Situation analysis-** understanding and evaluating need for a new concept, for this project this was provided by the APF.
- **Product proposal-** The product proposal is made for the lacunae area, new design for the CAL bus in this project .
- **Data collection and analysis-** The data collection stage included study of present scenario for user, usage and environment then the collected data is analyzed for proper inferences and probable design solutions.

Design Methodology

- **Idea generation-** The idea sketches are generated for solving the problems as derived from analysis. Ideas could emanate from images, story, situation etc.
- **Concept development and exploratory modeling-** Then clustering and evaluating of the idea sketches ia made so as to sort out the best effective solution. After this stage concepts are made which have the more informative representation of the proposed product.
- **Product detailing-** The final selected concept is further taken forward for detailing.
- **Evaluation and improvement-** The evaluation of product concept is made by mock up model analysis and user feedback. Thus, further refinement is made in the product.
- **Final Prototype development-** The final stage includes generation a prototype which provide a feel of the product.

Similar applications

User study

Activities while working

Best view of the monitor

Touching the screen to explain

Getting control of the mouse/ keyboard

Sharing with each other

Interest in other's task

Sitting

Posture

Position

Reach

Problems due to height

Mouse size is bigger w.r.t. palm size

Problems

Position of Switches

Wiring cluster

Outsiders perspective

Govt. schools

Problem Identification: for Children

Problem	Probable solution
Leg hanging from the chair	Reduction in chair height
Hands have to be kept at the higher level	The keyboard support has to be lowered
Children have to lean forward to monitor	Reduction in the distance between monitor and child
Headphones have to taken out with a bit of difficulty	Replacing the strings for headphone resting
Mouse cannot be held easily	Use of smaller mouse
Wires get entangled during use	Placing the wires other than from side lower
Have to come out of the seat to help the other children	Changing the seating pattern
There is a bit difficulty in climbing Ist step	Provision for an extra step
Curtain has to moved for viewing outside	Providing proper channel for interaction between outside and inside

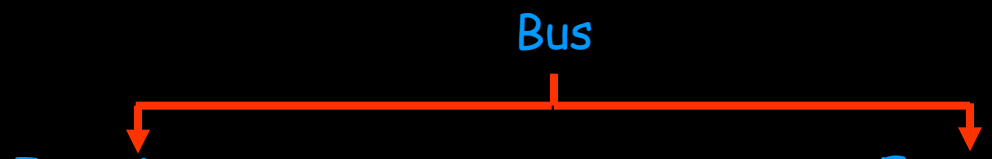
Problem Identification: for Helper

Problem	Probable solution
Cleaning is difficult due to switches position	Switches has to be placed out of reach of children
Furniture has to be placed and removed daily	Reduction in the movable furniture and other objects
Monitors are to be fixed before and after use	Maintaining the internal temperature in the range of 27-30 deg./ reduction in humidity.
Internal Temperature becomes more	Fixed resting place for keyboard and mouse
Charging extension wire has to taken from driver back	
Keyboard and mouse placement after use	

Problem Identification: for Tutor

Problem	Probable solution
Loose connection between headphone jack and CPU	Providing the fixed wirings within the bus body
Internal Temperature becomes more	Temperature maintenance
CPU maintenance is difficult due to orientation and placement	Making the reach to CPU simpler
Non uniformity of light	Providing sufficient sources for proper diffused light

Composition



Interiors

- Work station
- Lightings
- Floor
- Stairs
- Air vents
- Speakers
- Place for Projector
- Wire harness
- CPU place
- Hand rail
- Color

Exteriors

- Graphics
- Window glass
- Head lights

Project Brief

User

The age group is decided to be between 7-11 yrs

The seat height to made at 137mm

The height of the table at

The wirings ahs to be cased and boxed

The step size is made

Horizontal- 178mm

Vertical- 172mm

Provision for additional movable step for reduction in height of first step.

Use of smaller keyboard and mouse according to the children's grip

Enhancing the playful elements

Bus

Reduction in the number of elements in contact with the floor for easy cleaning

Reducing the no. of fixed components to reduce the effects of vibrations during bus movement

Two doors for entry and exit

Capacity increment (48-56)

Internal Temperature range (27 - 30)

Providing space around CPU for easy maintenance

Activity

Orientation of seats to improve group interaction

Headphone placement has to be rigid

Provision for proper and sufficient distribution of light (natural/ artificial)

Ideation

Idea generation involved the development of innovative solutions to the problem analyzed after data collection.

They were further focused as layout, workstation, interior and exterior of the bus body.

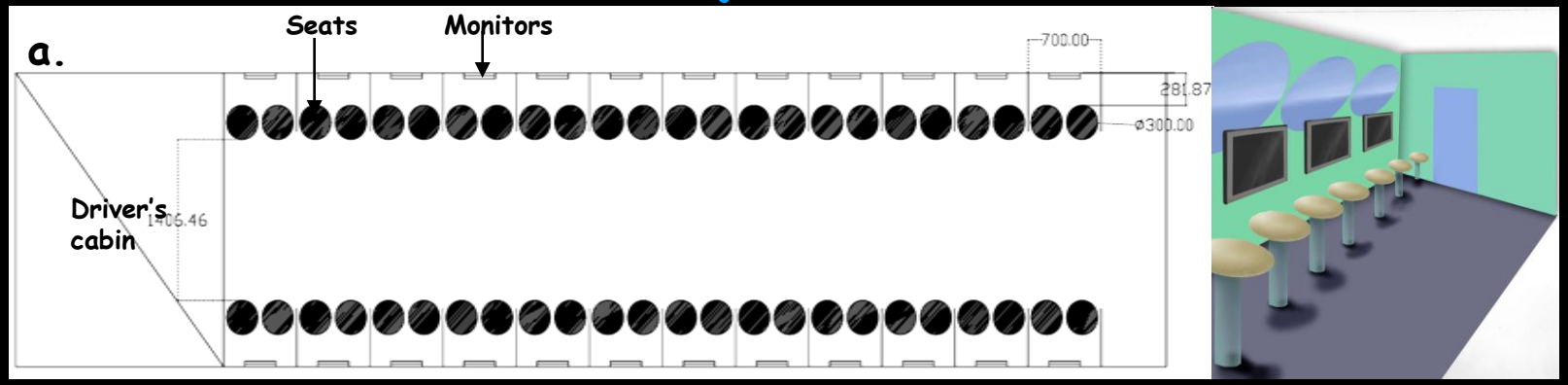
Layout

Finalizing the layout was the first requirement so that the other components could be build upon that -

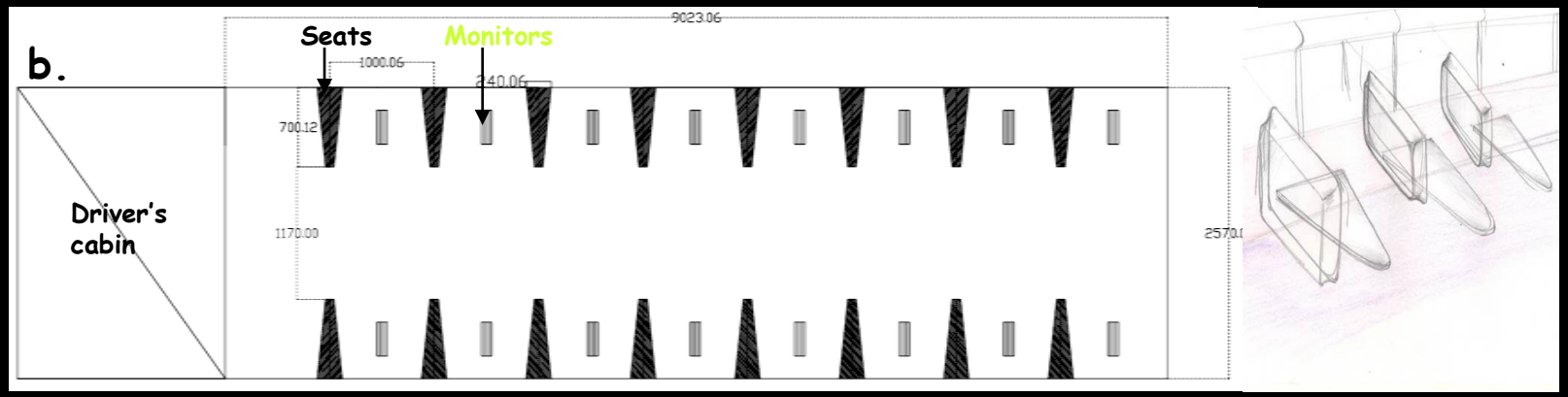
Considerations for making the layout were -

- Playfulness
- Relation to the children's activities
- Easing the movement of people between the workstations
- Modularity i.e. repetition of similar components for ease of manufacturing
- Wiring harness
- Safety
- Maintenance reduction

Layouts

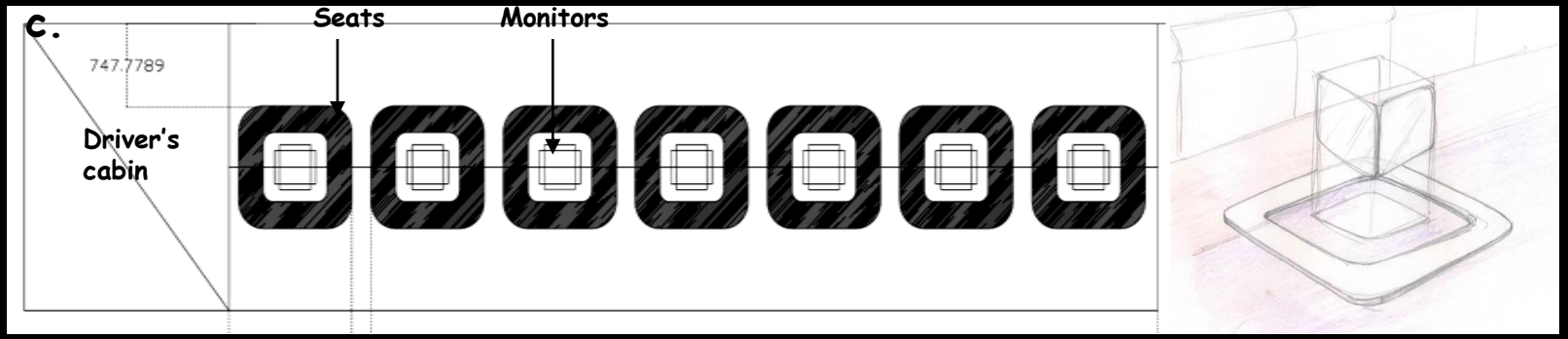


In this layout, the monitors are arranged in linear fashion, along the wall of the bus body. Characteristic feature of this is the presence of space at the centre area of the bus.



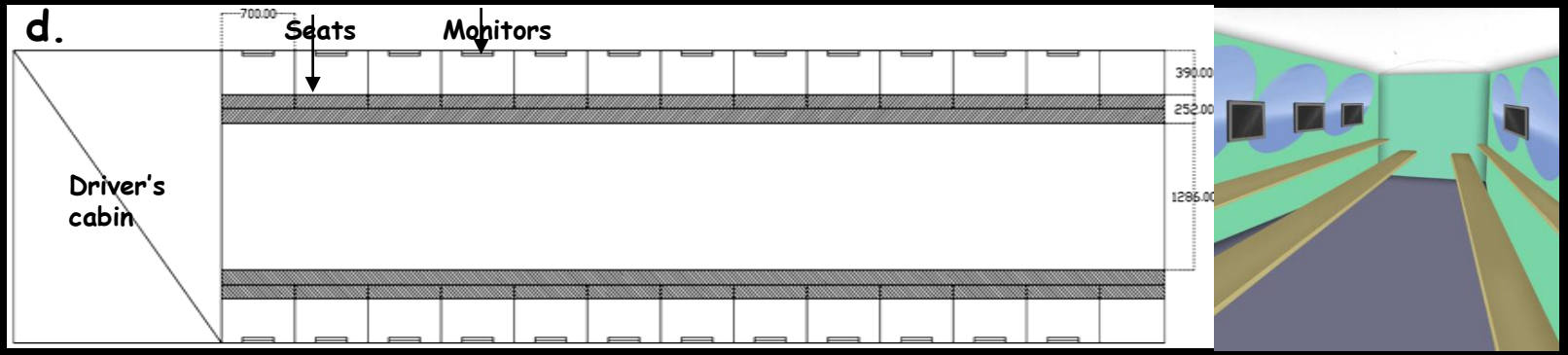
In this layout, the monitors are perpendicular to the wall of the bus body with two monitors placed back to back. Characteristic feature in it is the common seat for two rows of children.

Layouts



In this layout, the monitors are in a square pattern, at the centre line of the bus

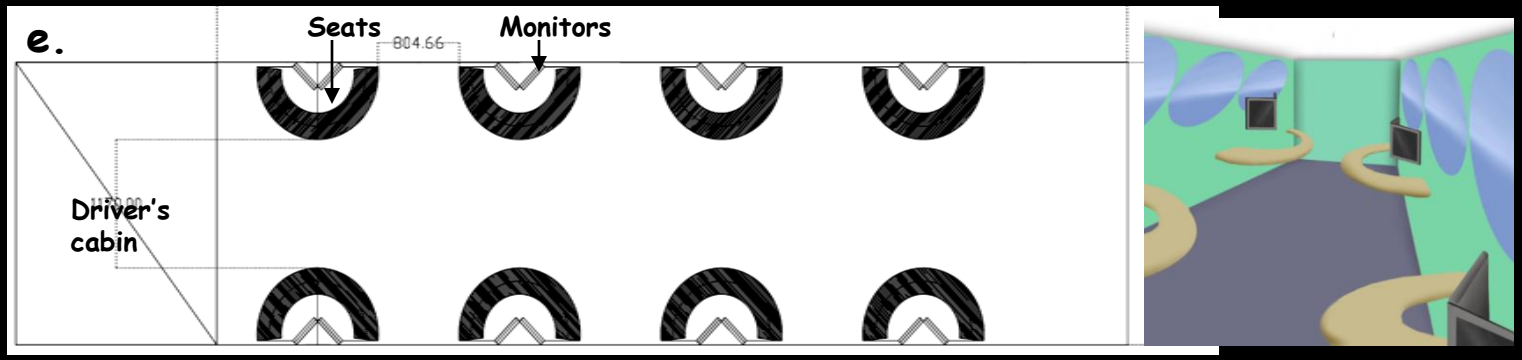
Characteristic feature of this is the presence of free space along the wall of the bus body.



In this layout, the monitors are parallel to the wall of the bus body.

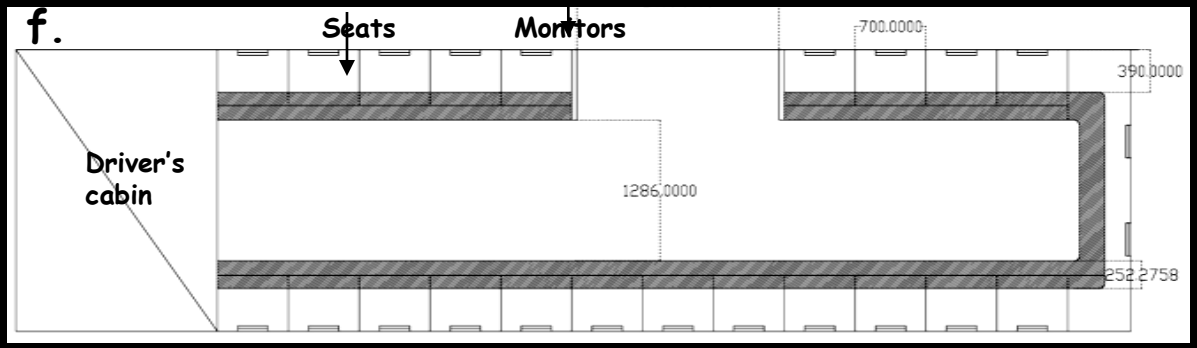
Characteristic feature in it is the common continuous seat for children.

Layouts



In this layout, the monitors are in a triangular pattern, at the wall of the bus body.

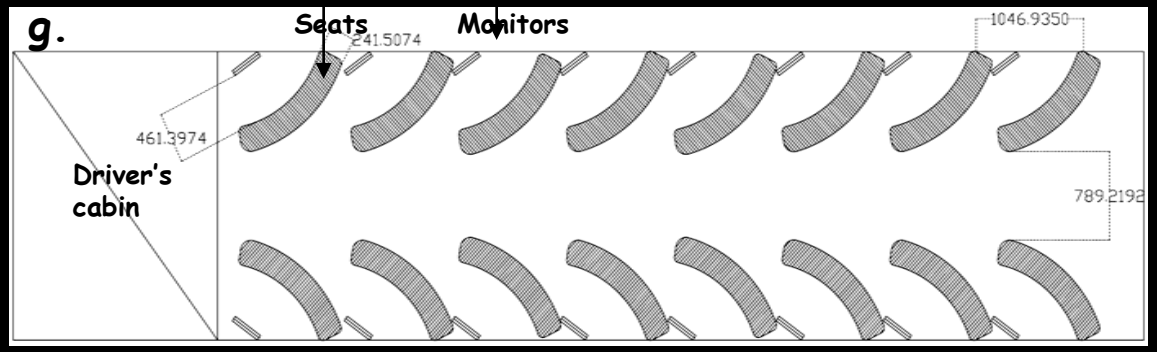
Characteristic feature of this is the presence circular pattern of seats.



In this layout, the monitors are parallel to the wall of the bus body.

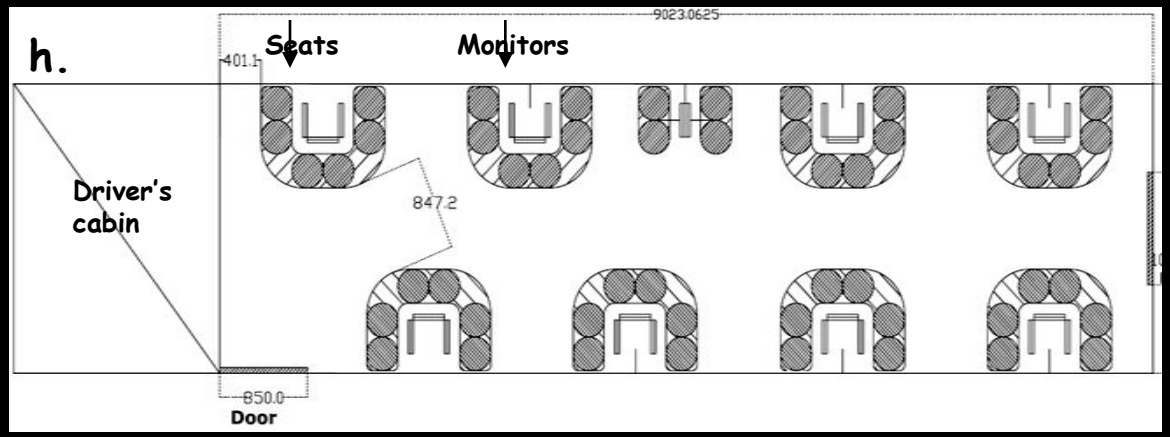
Characteristic feature in it is the common continuous seat for children with entrance at the bus centre.

Layouts



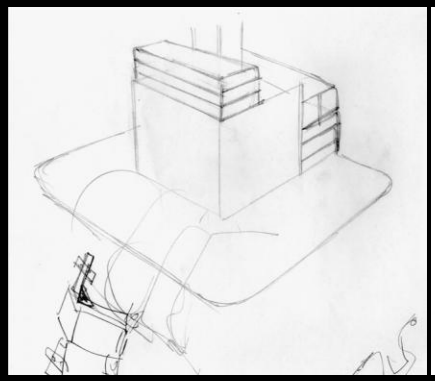
In this layout, the monitors are tilted at an angle, to the wall of the bus body.

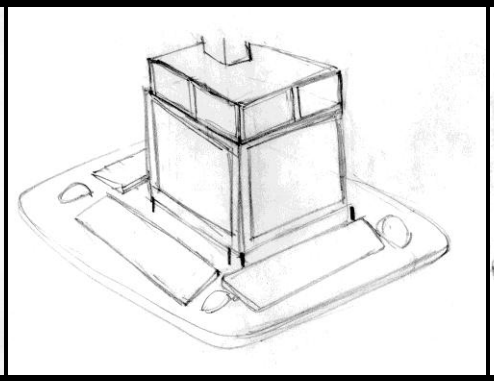
Characteristic feature of this is the presence arc like pattern of seat around the monitor.

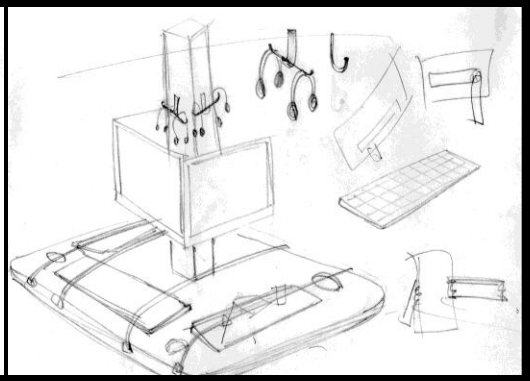


In this layout, the monitors are placed parallel to the wall of the bus body, in D-type pattern. Characteristic feature in it is the half-square seating around the monitor consoles

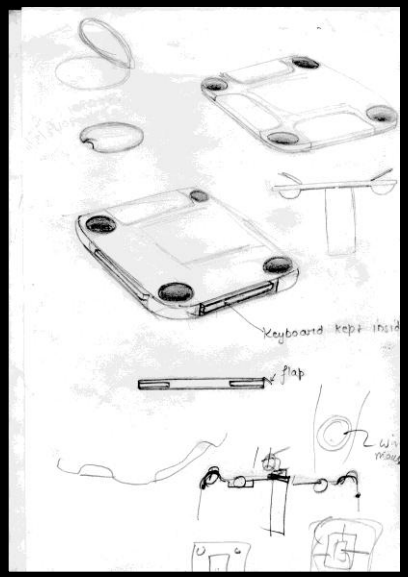
Workstation



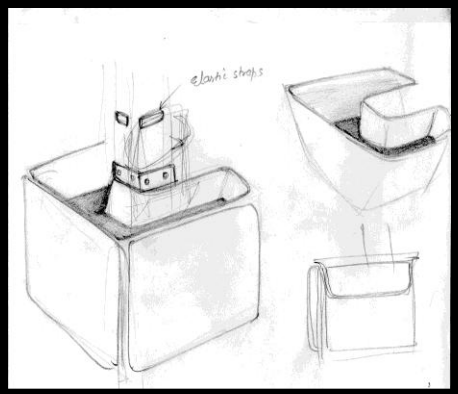


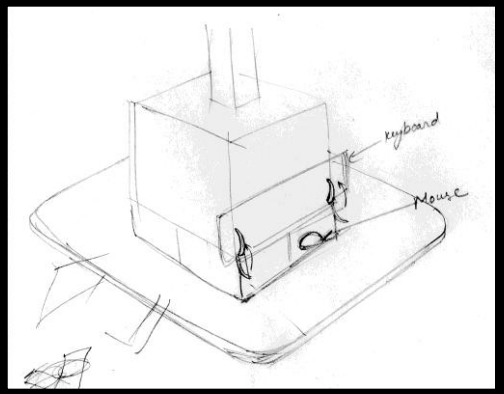


Different possibilities were explored for storage of mouse and keyboard

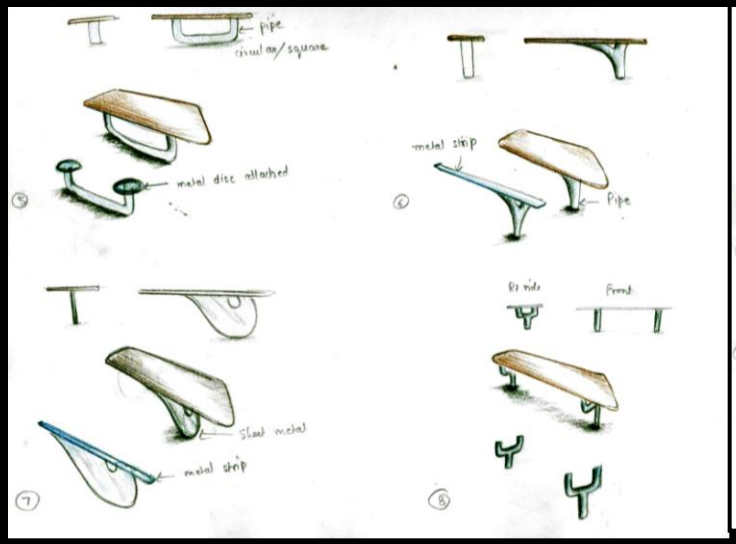


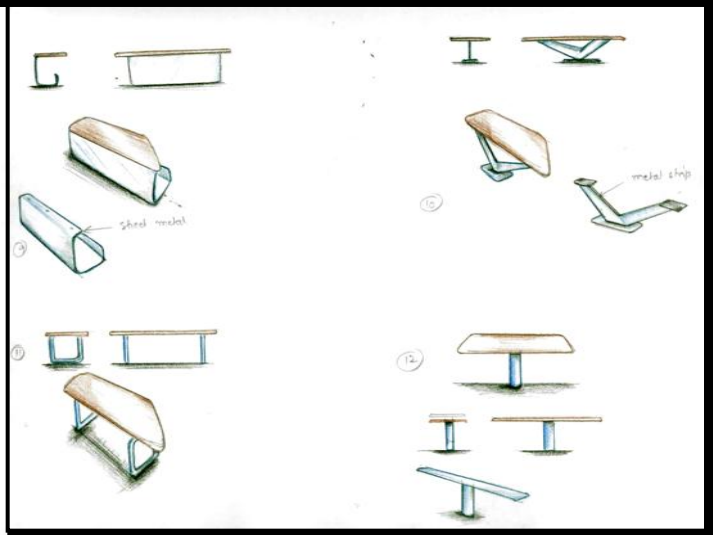
Exploration was also done to know the most effective place so as to reduce unnecessary clustering





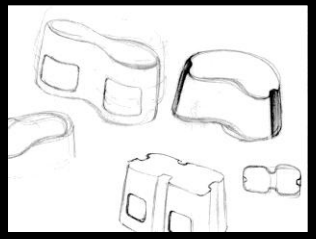
Seats





The features considered for the seats were

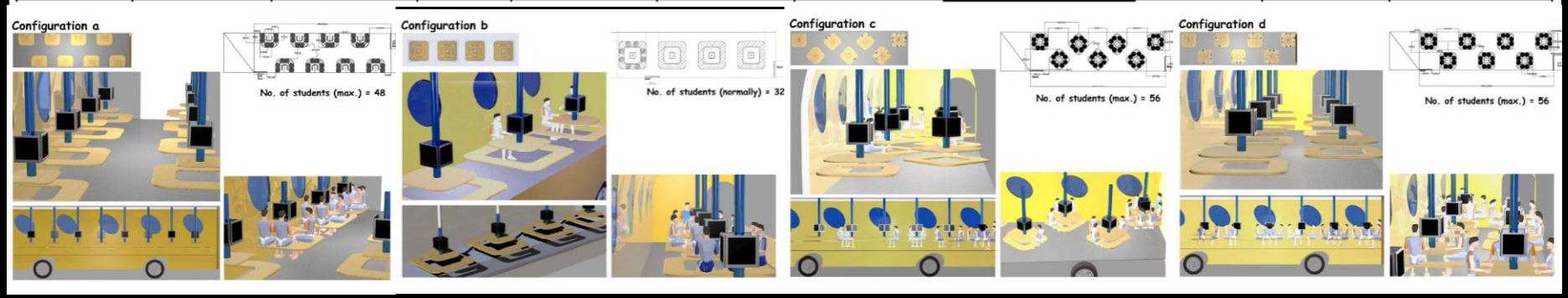
Storage after use, flexibility of usage, low weight, easy maintenance, durability, playful form



Conceptualization

Layout selection

Layout	Ease of movement	Sitting interaction	Open spaces	Uniformity	Simplicity of object placement	Playfulness	Modification possibilities (space context)	No. of seating	Leg space	Total
a	9	9	9	7	7	7	9	7	6	70
b	7	5	3	9	9	2	2	5	9	53
c	5	6	6	4	2	8	5	9	2	47
d	3	3	7	3	6	9	7	9	2	49



Concepts were marked out on a scale of **1 – 9** with,

0 - representing least effective solution

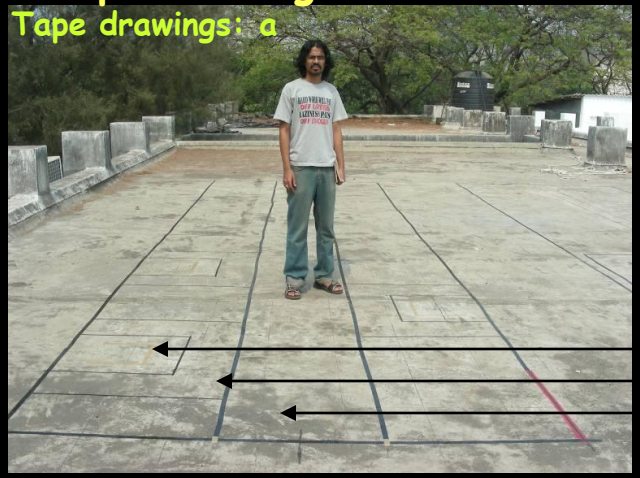
9 - representing best solution

Hence, the highest scorer layout "a" ; was selected for further improvement.

Full scale simulation

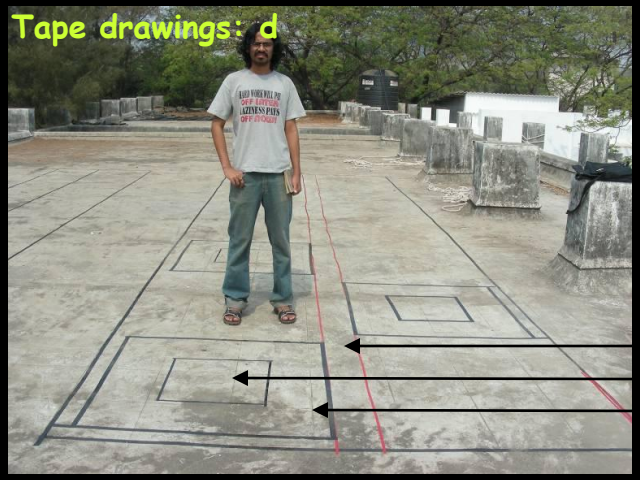
1.Tape drawings

Tape drawings: a



Monitor position
Seat position
Passage

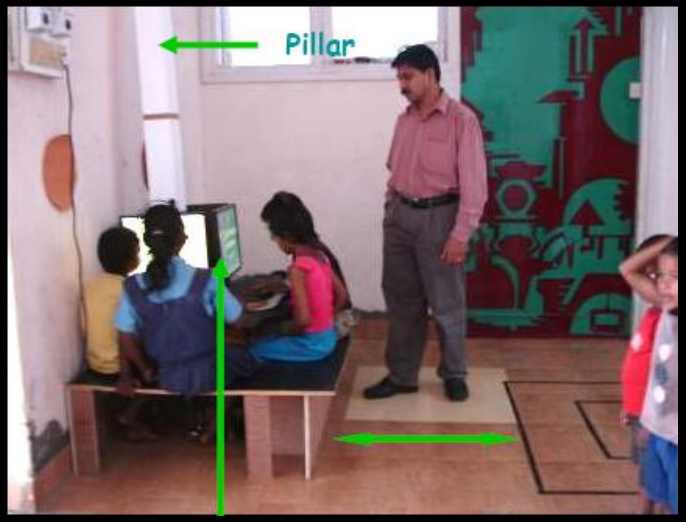
Tape drawings: d



Passage
Monitor position
Seat position

These drawing were made to visualize the full scale area being used in the layout , as well as to know the relation of objects with the users.

Mock up model- for feed back analysis



TFT monitors

Partial layout of the bus

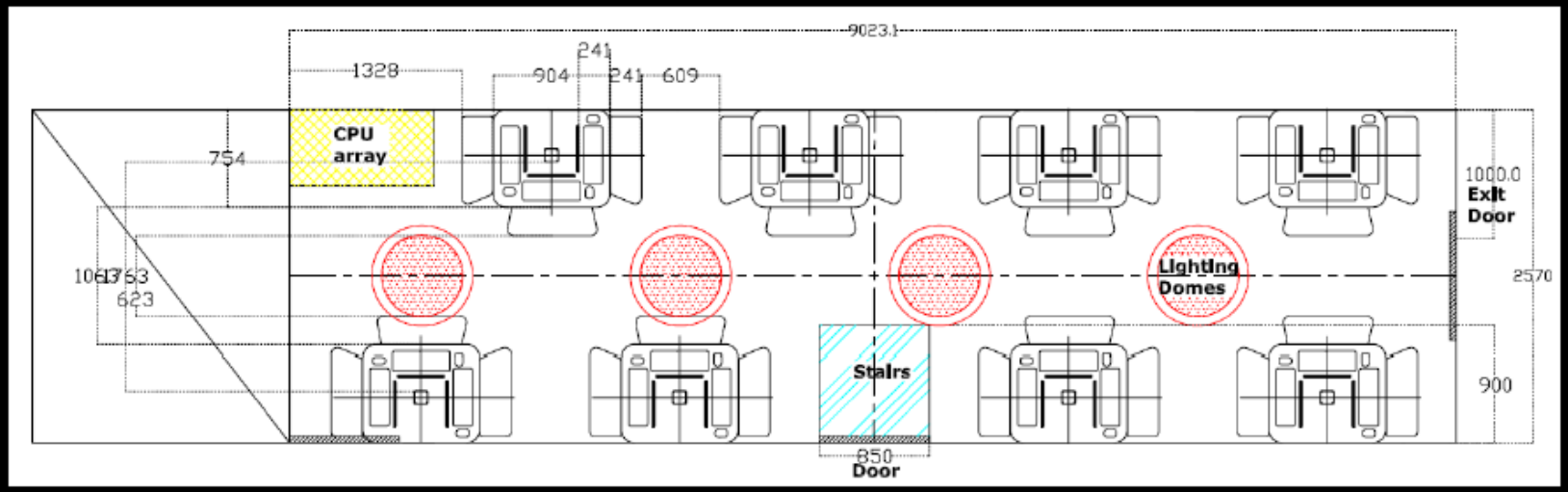
Feedback analysis

- Enough leg room.
- Seating space optimized.
- Height of monitors adjusted according to the children's height
- Distance between monitor and child modified.
- Space for the placement of mouse is enhanced by increasing the table length.
- Margin provided for keyboard of the side monitors.
- As well as smaller keyboard option explored
- Mode of entrance into the console cleared by splitting of the single bench seat.

Work station

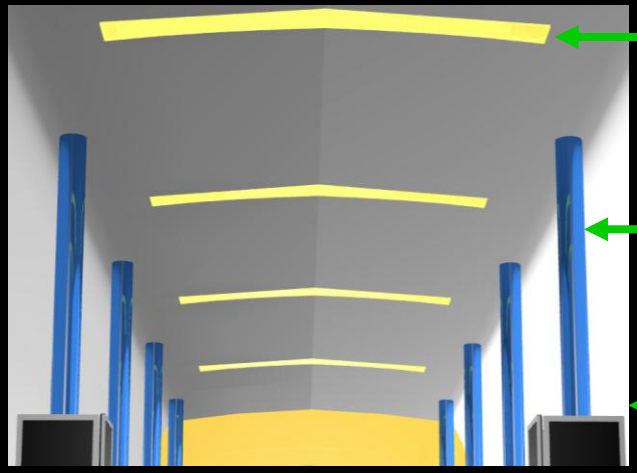
D-type layout centered around a column

- Seats
- Table
- Monitor holders
- Resting place for keyboard, mouse and headphones



2-D Layout

Lighting requirements



Translucent polycarbonate for providing natural diffused light

LED lights on the pillar

Windows

Polycarbonate dome -

Characteristics of the light source

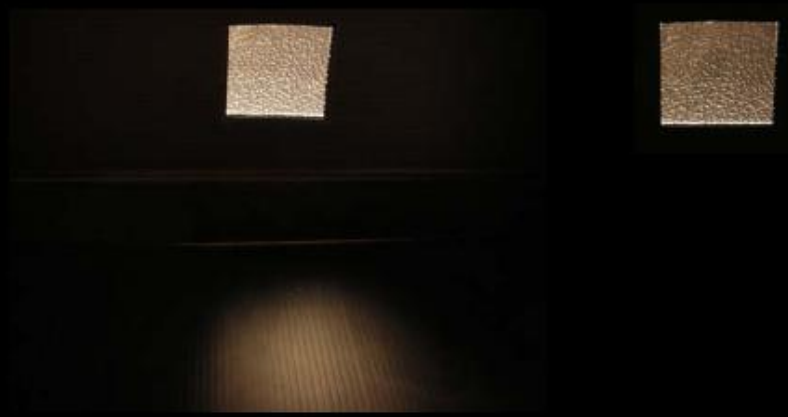
- Uniform diffusion
- Maintenance of sufficient intensity
- Reduction in glare

Selection of Dome type roof outlet was done in accordance with the theme of playful form and in accordance with windows also

Light quality testing: for roof dome material

Plain light

Plain linear textured acrylic



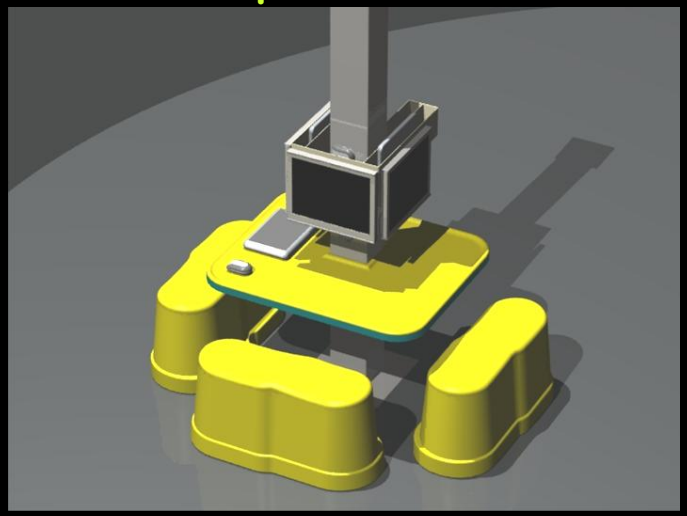
Plain textured acrylic

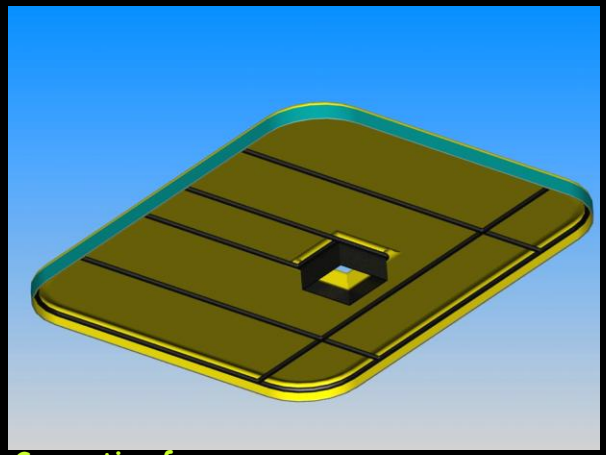
Tinted acrylic

Final product detailing

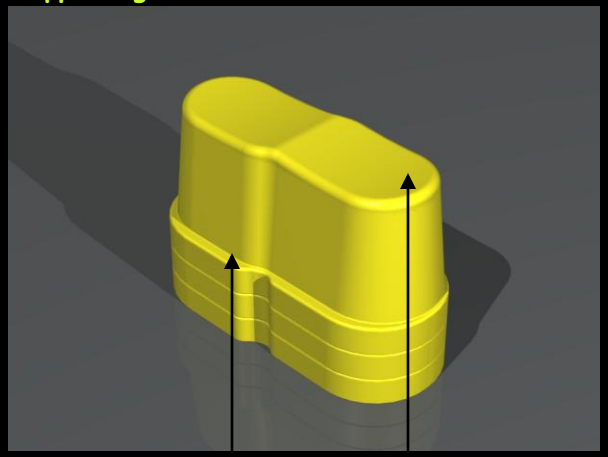
Work station- Ist option

Concept 1





Supporting frame



Molded seats (thermoformed):

- Stackable
- Flexibility of use
- Colour options
- Ease of maintenance
- Lightweight

Molded table :

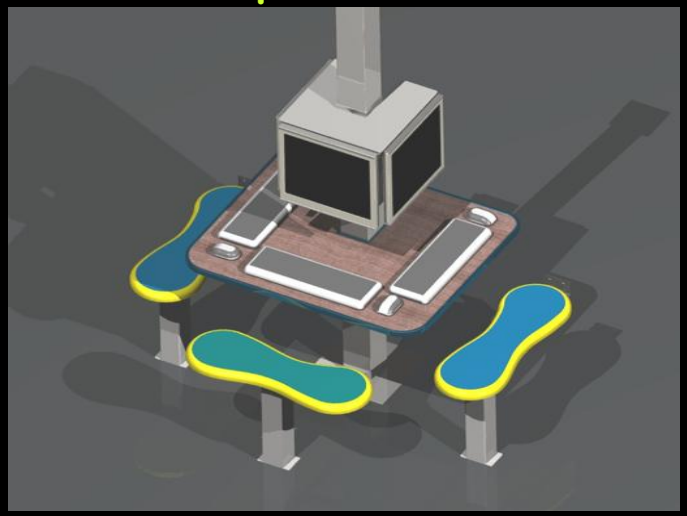
- Light weight
- Any form possible
- Colour options
- Ease of maintenance
- Contouring possible

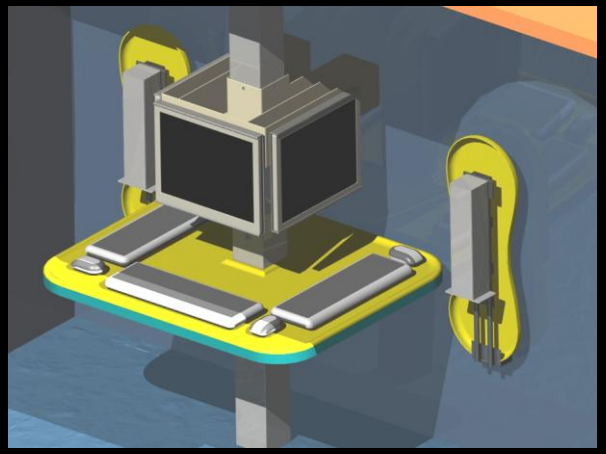
Space for foot rest

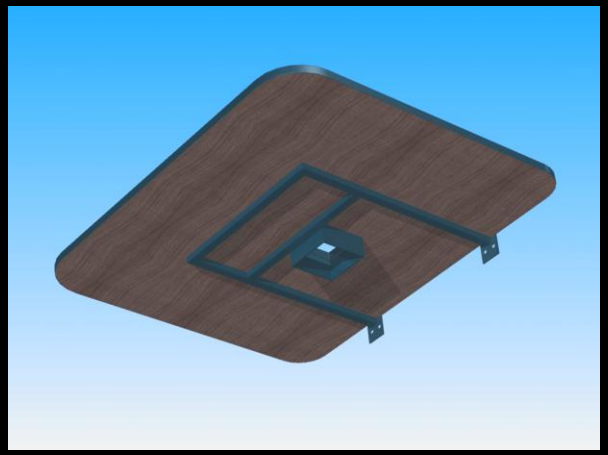
Contouring

Work station- IInd option

Concept 2







Supporting frame

Wooden/ Plastic molded top on steel frame base

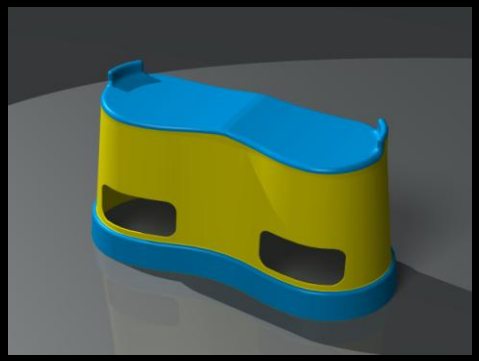
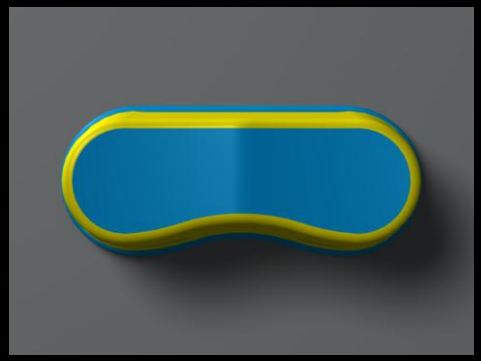
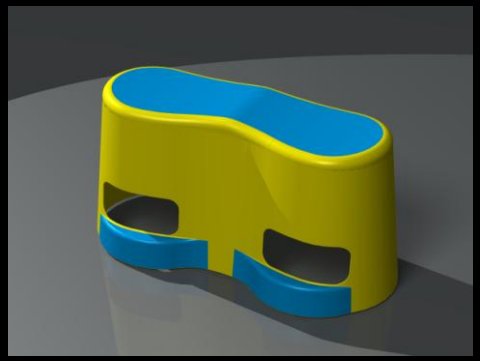
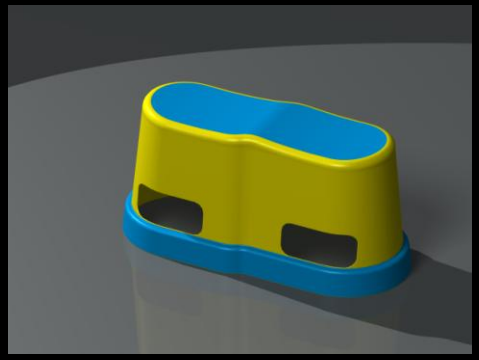
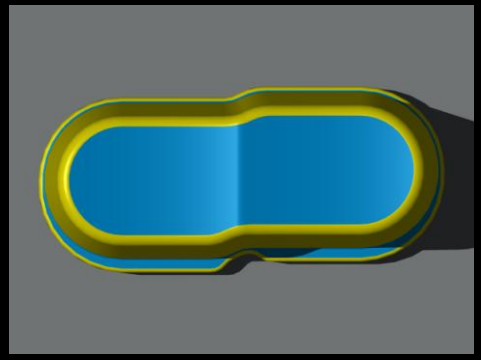
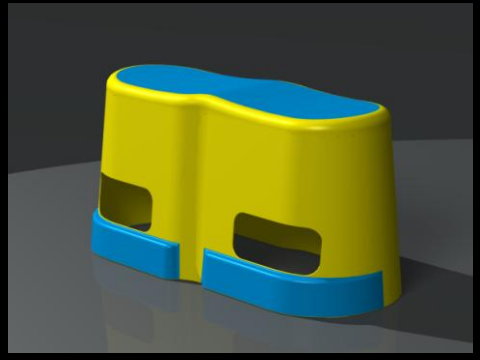
Fixed seats:

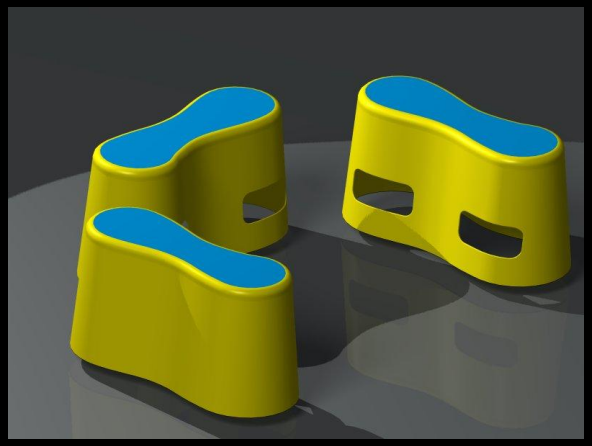
- Foldable
- Limited flexibility in terms of placing
- Requirement of metal frame for support
- Maintenance requirement

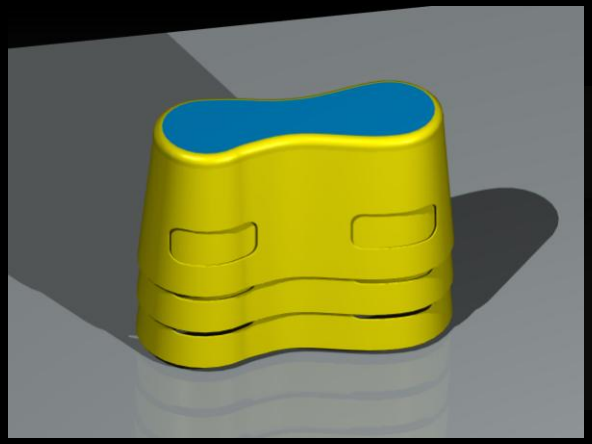
Wooden table:

- Heavy
- Limitations in case of fillets
- Requirement of metal pipe frame
- Maintenance requirement

Seat form options

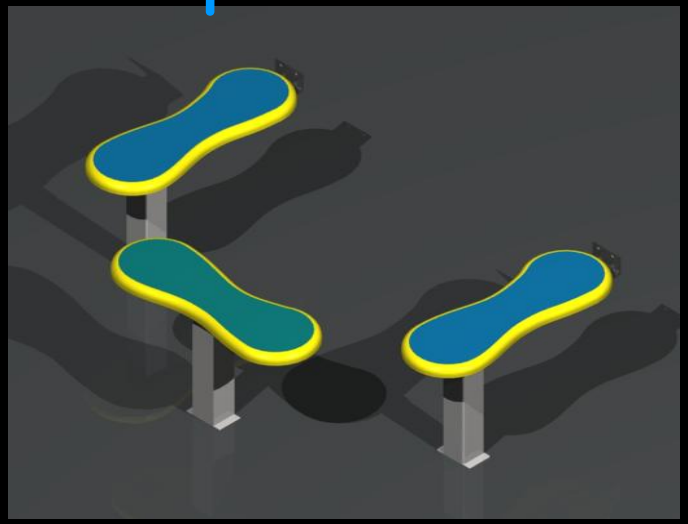









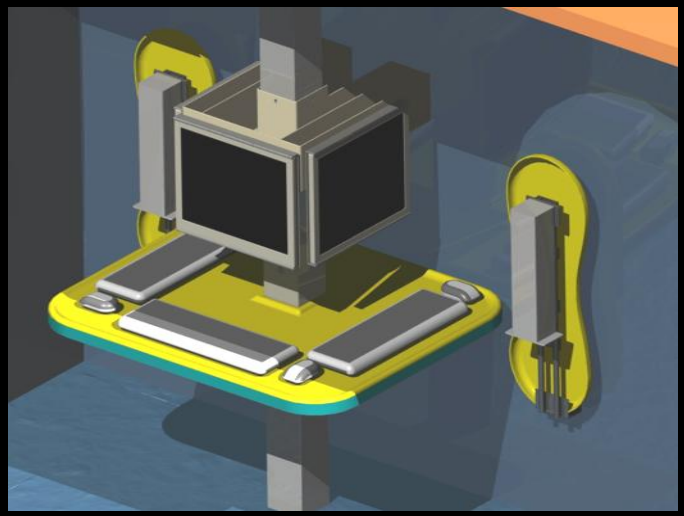



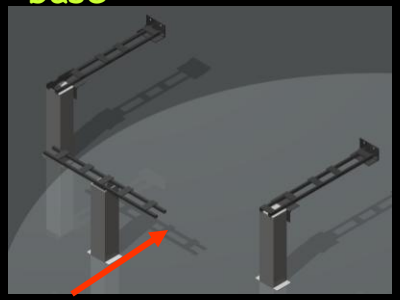
Seating

Concept 1



Plastic molded top on steel frame base

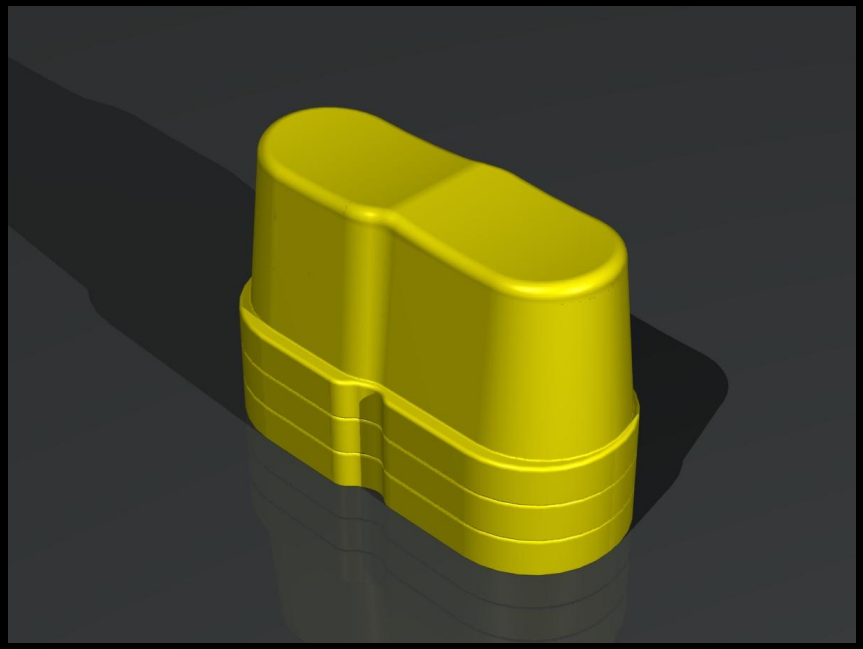




Direction of movement

Seating

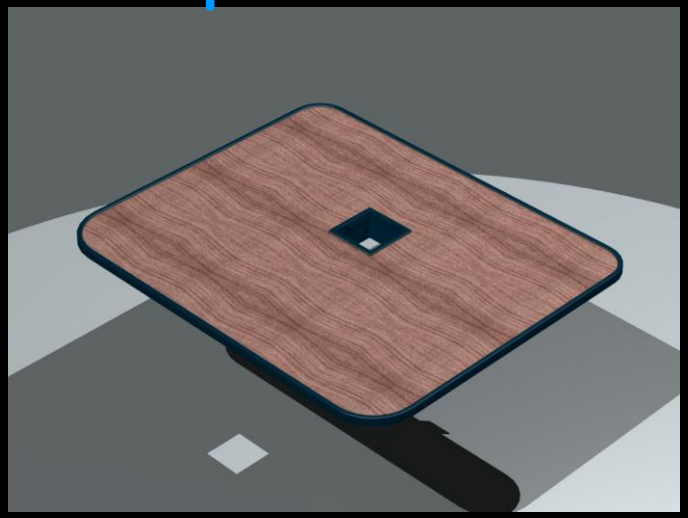
Selected Concept



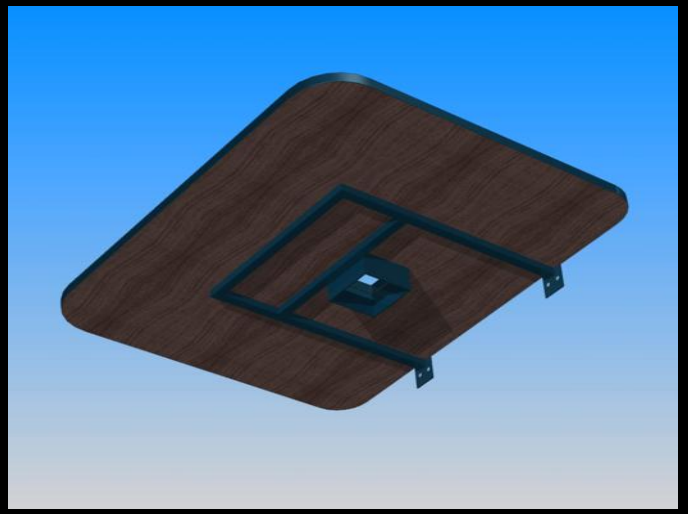
2-D drawing

Comparison

Concept 2



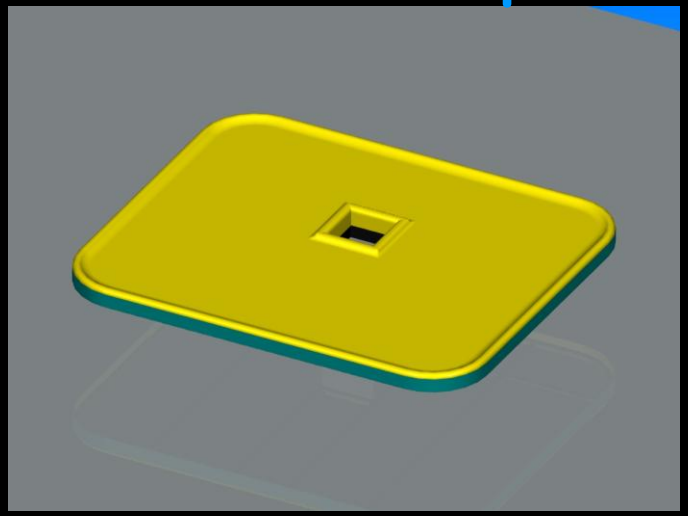
Wooden top with metal pipe frame



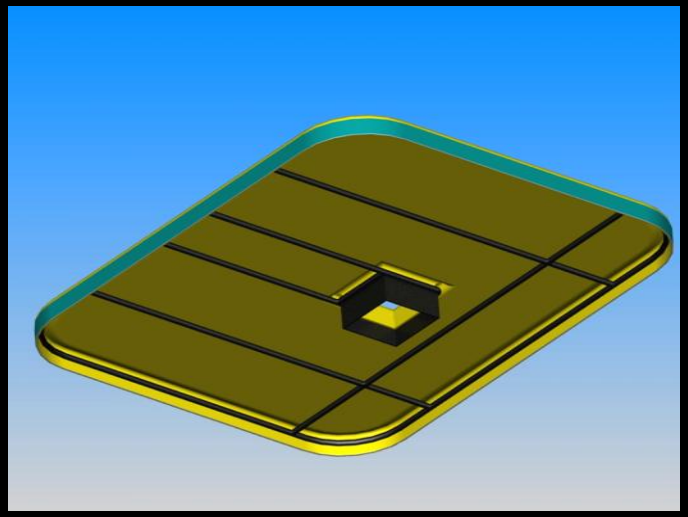
Supporting frame

Table Concepts

Selected Concept 1

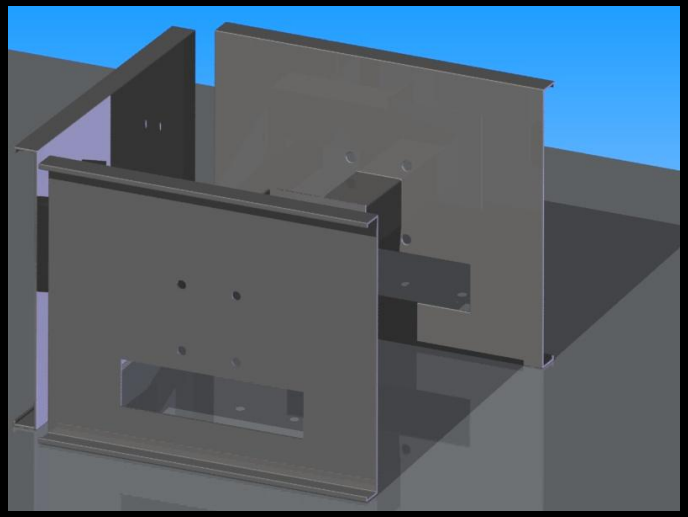


Plastic molded

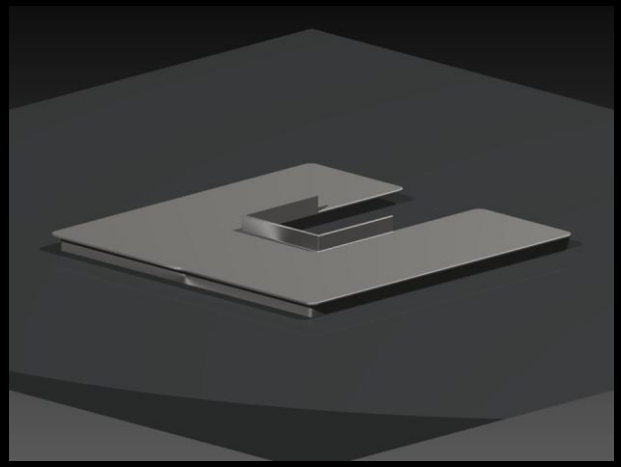


Comparison

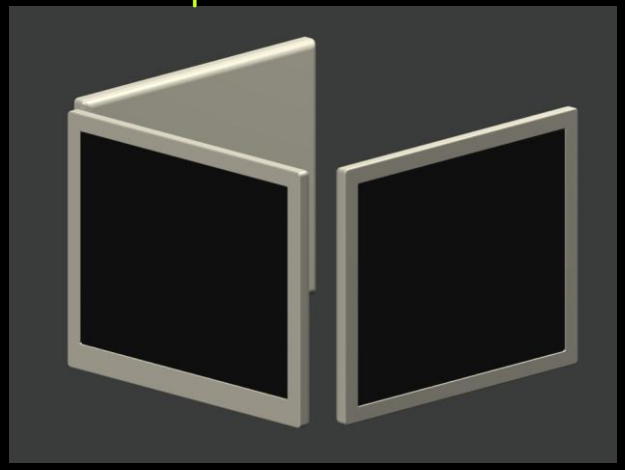
Monitor assembly



Sheet metal holding frame



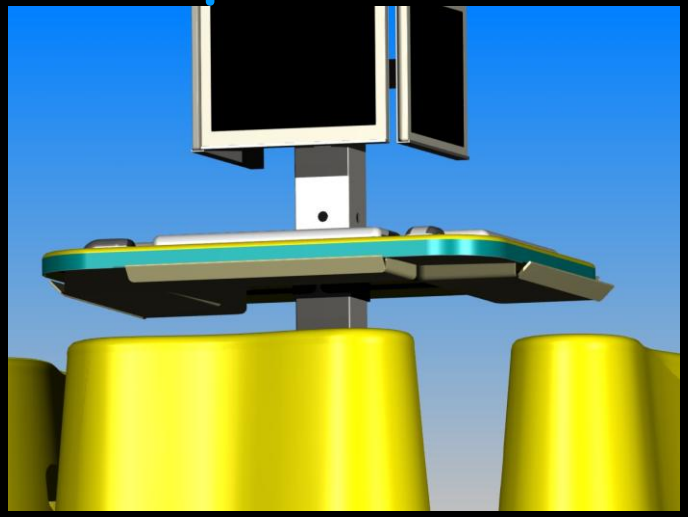
Plastic top cover

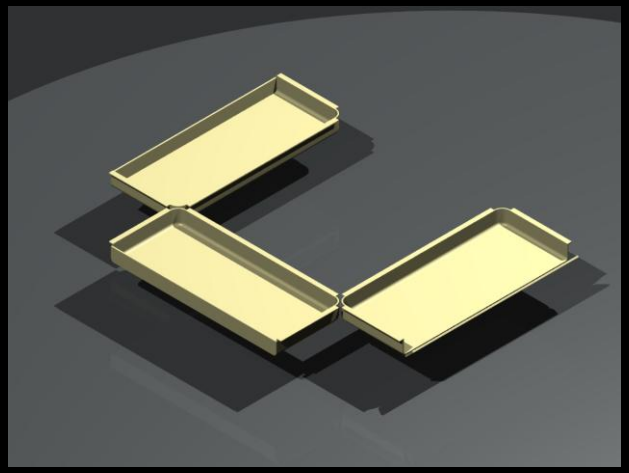


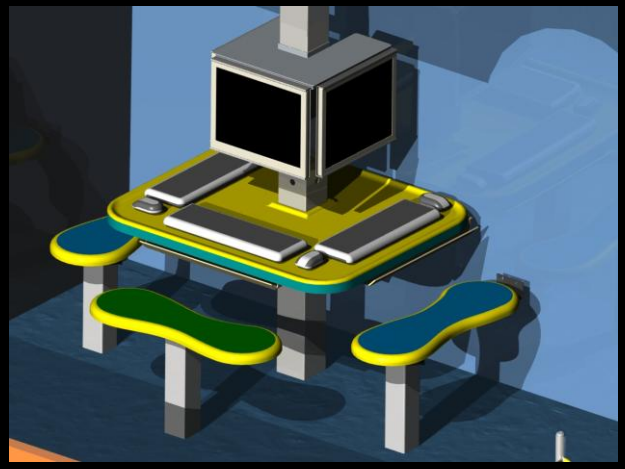
Monitor placed in D-pattern

Key board and mouse resting

Concept 1







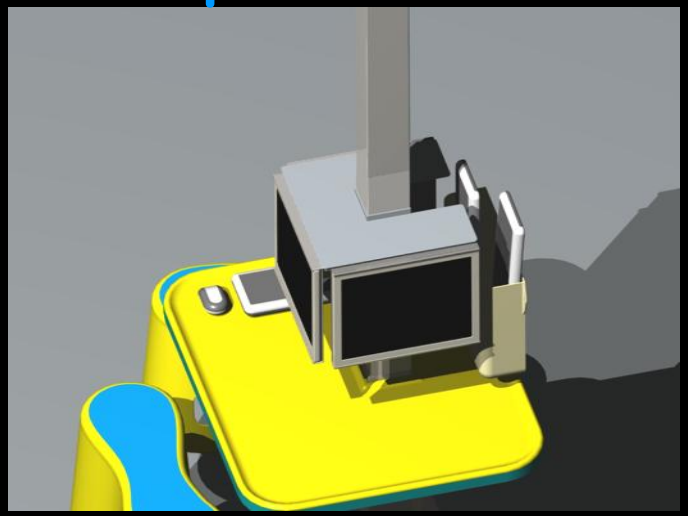
Fixed under the table

FRP keyboard/ mouse holder

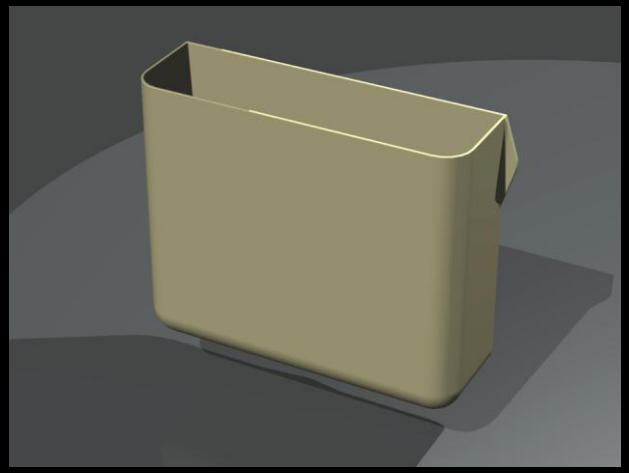
Features

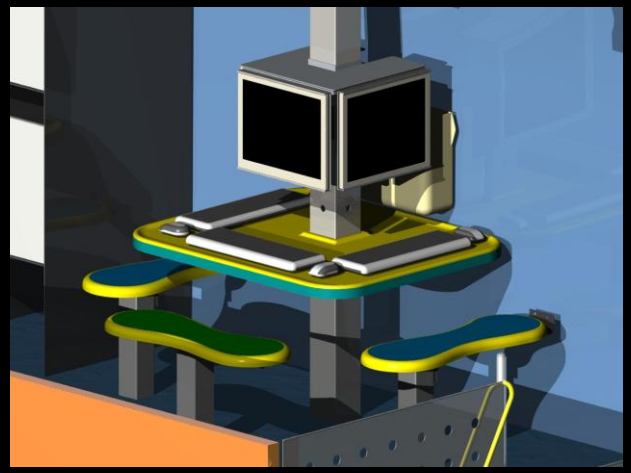
Key board and mouse resting

Concept 2



Fixed behind the monitors





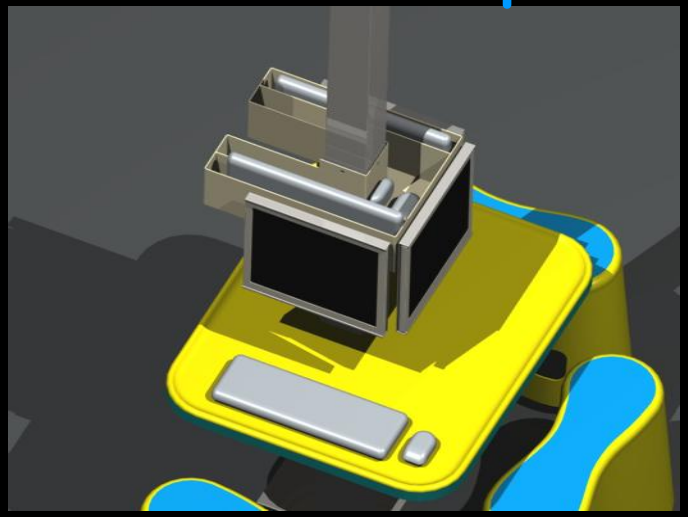
FRP keyboard/ mouse holder

Features

Proposed keyboard

Key board and mouse resting

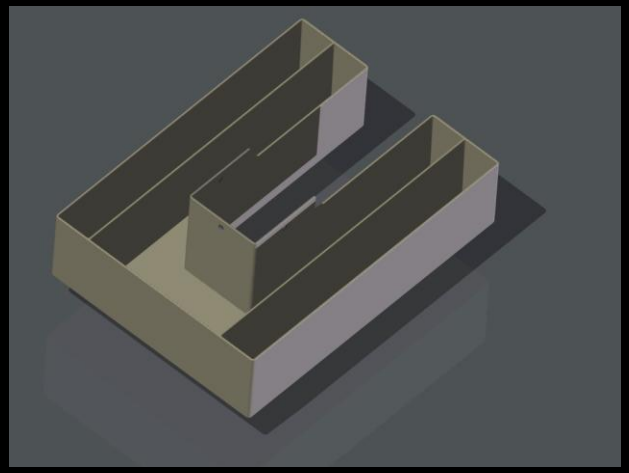
Selected Concept

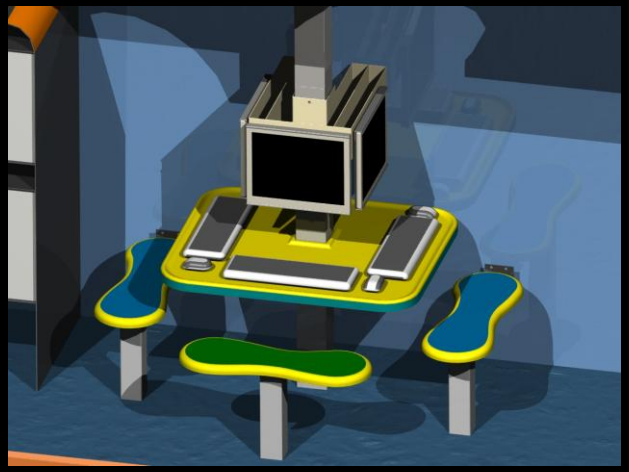


Fixed behind the monitors

Features:

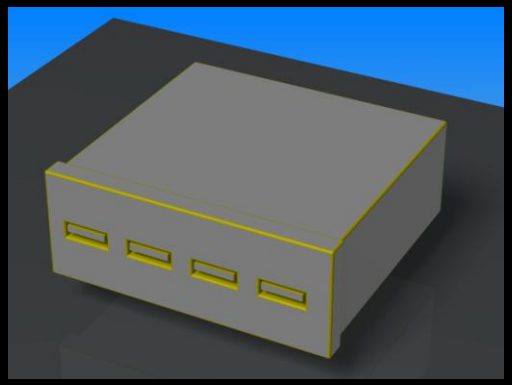
- Quite visible from the above
- Integrated with the monitor console
- Lightweight (ABS plastic)
- Utilization of free space
- Can be left open
- Wires may cause clutter
- Keyboard/ mouse could be fixed by use of cushion material

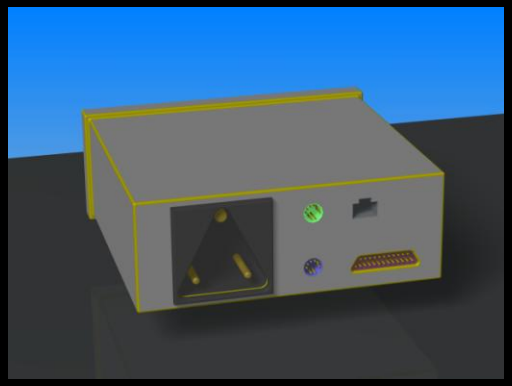




FRP keyboard/ mouse holder

Proposed keyboard

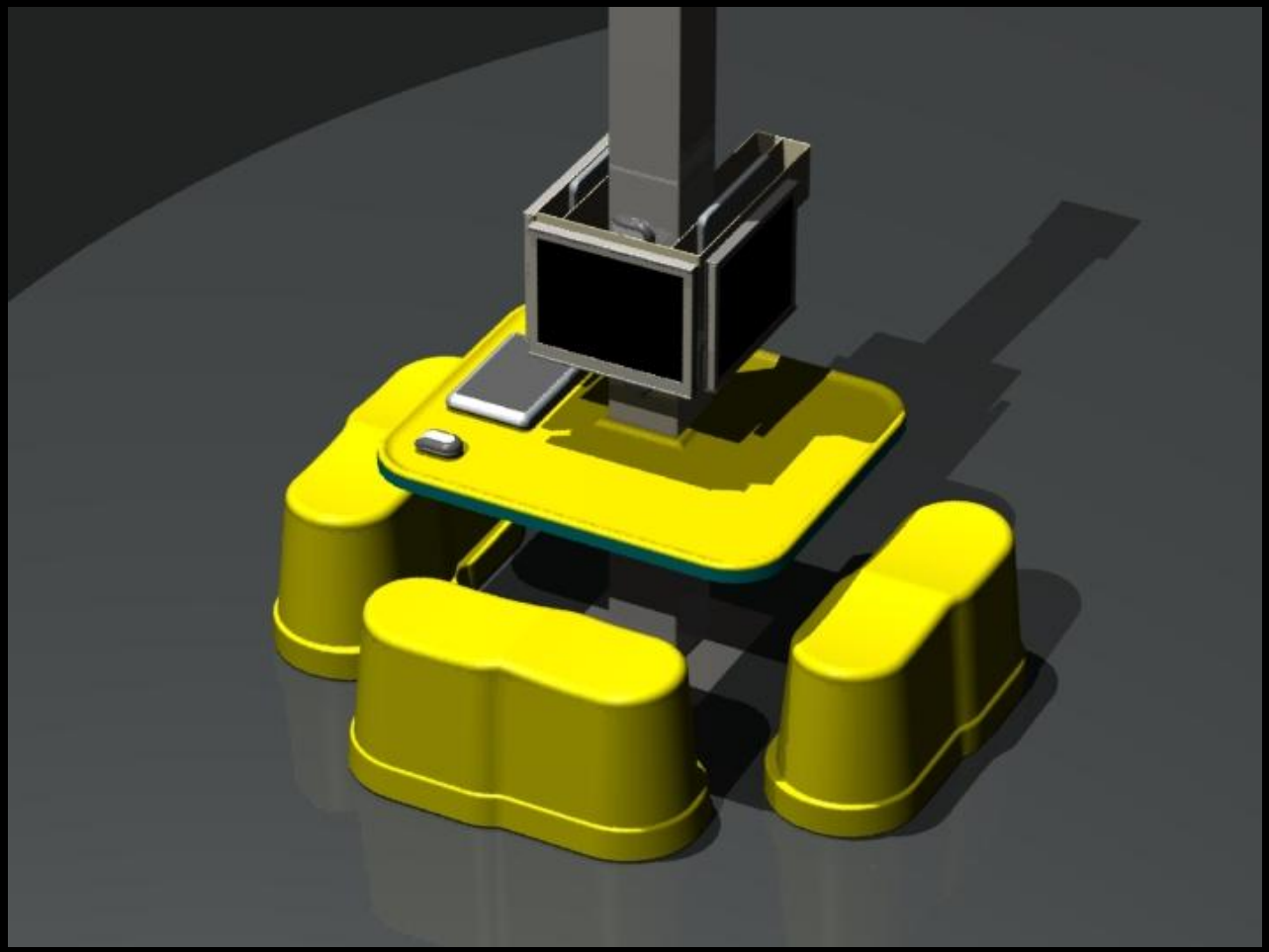




Proposed Monitors

12cm * 12 cm

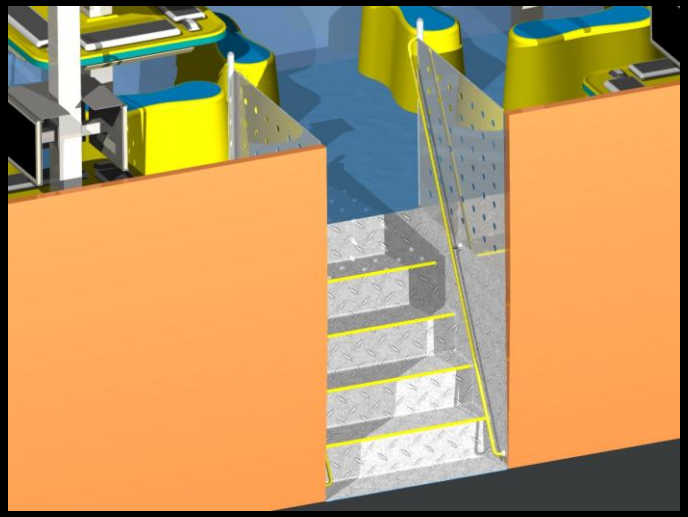
Final workstation

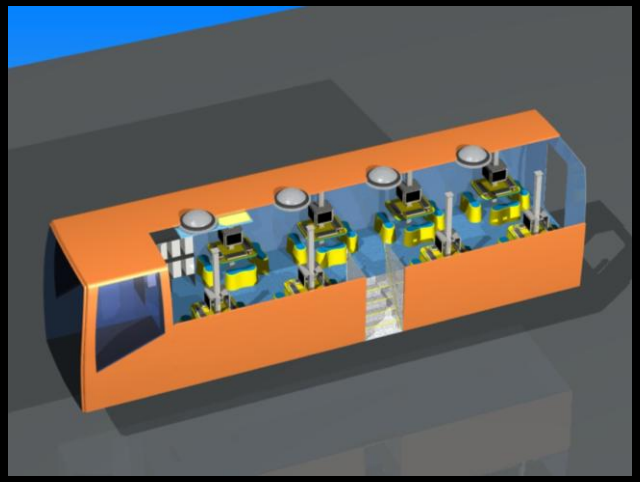


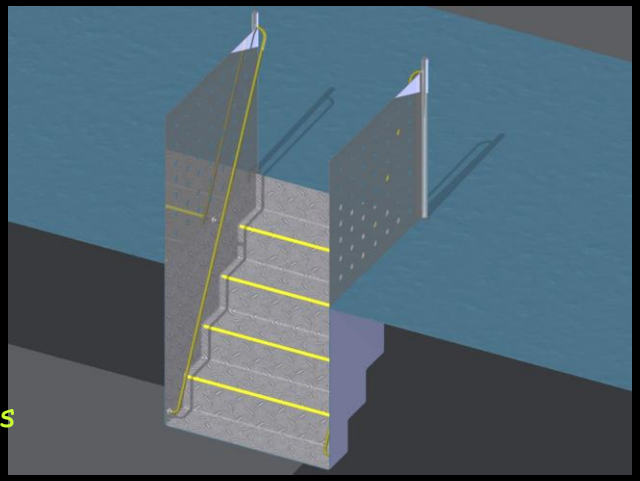
Considerations for the workstation

- Keyboard is under fingers when upper arms are relaxed at sides and elbows are bent to about 90 degrees.
  Wrists are straight
  Upper arms are relaxed at the sides of the body.
- The mouse should be located next to the keyboard so that it is easy to reach.
- The wrists should be straight when keying or using the mouse
- The monitor should be directly in front of the student so that no neck twisting is required to view the screen. The top of the screen should be below eye level.
- The student should not have to bend his/her neck backwards to view the screen. Watch that the chin doesn't poke out when using the computer. This posture is hard on the neck tissues and may happen because the monitor is too far away or because the student is concentrating on whatever he/she is viewing.

Location of stairs

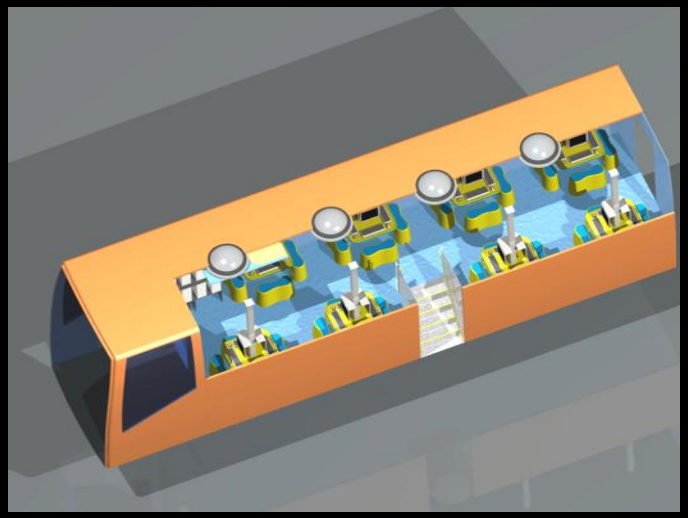






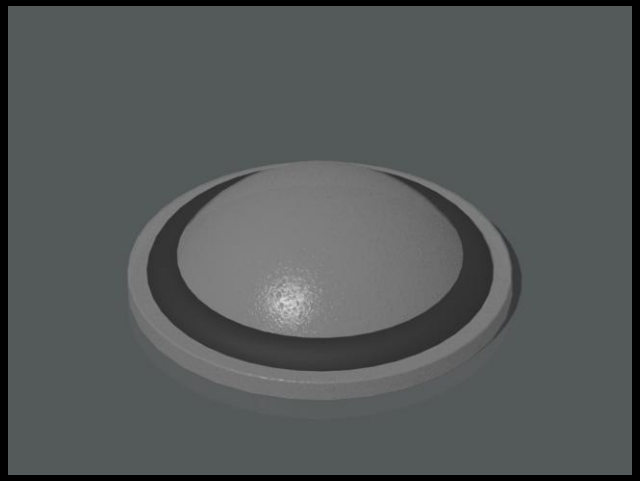
- Hand rail is PVC coated,
- Bright yellow colored for indication of change of plane
- Side grills erected to prevent accidental falling as well as for support
- Options for front entrance and middle entrance were explored , but the criterion of ease of movement, as well as enhancing the playful element were used to decide on the current position.

Natural opening through the roof



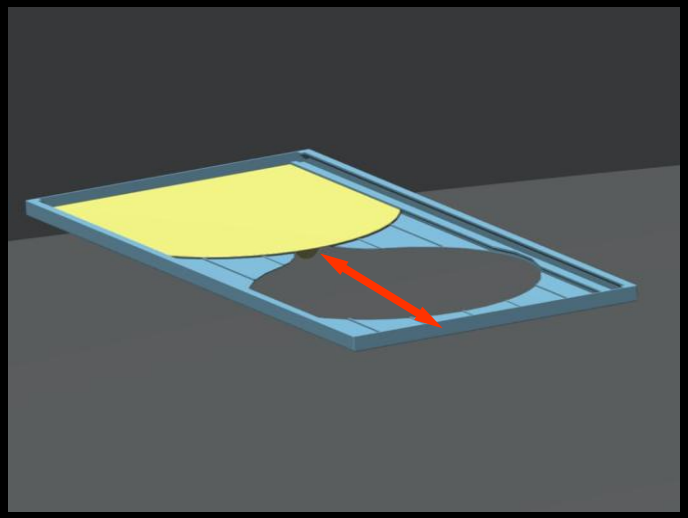
Translucent polycarbonate dome

The dome were placed for provision of uniform diffused light as well as providing an element of surprise, especially during monsoon season.



Lined with rubber gasket

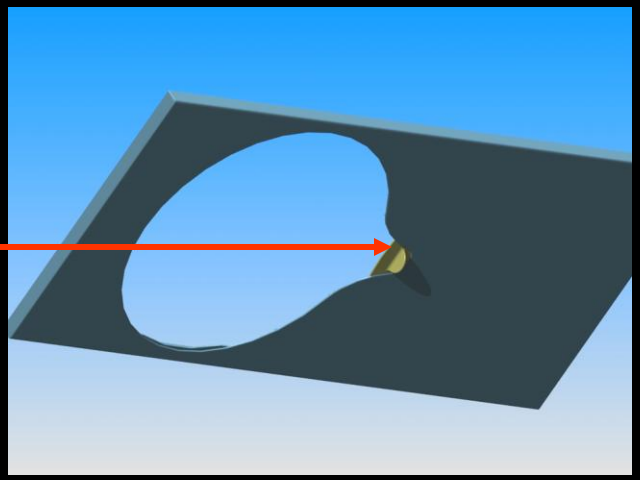
Panel to control light through dome

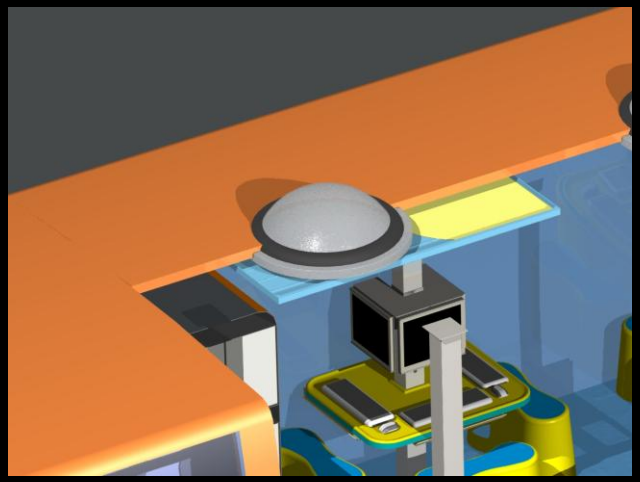


ABS panel with slider

Slider has to pulled out for reducing the light in case of non-requirement i.e. at the time of presentation

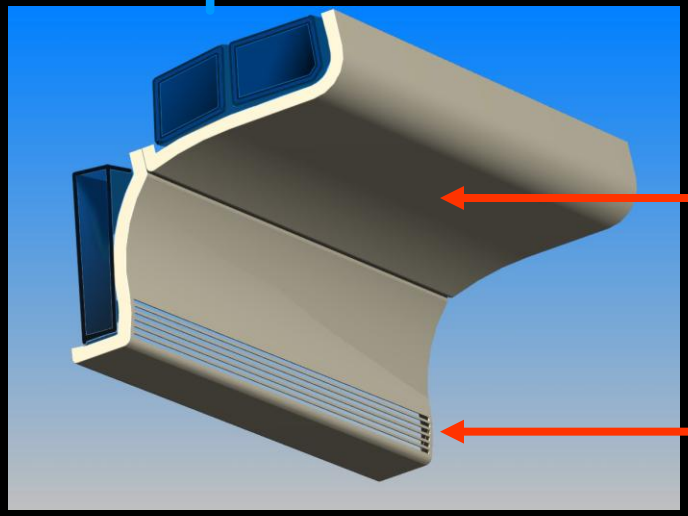
Slider





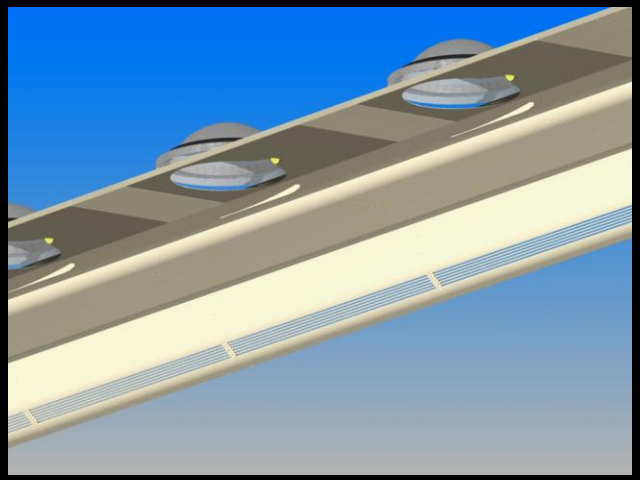
Wiring and Air conditioning ducts

Concept 1

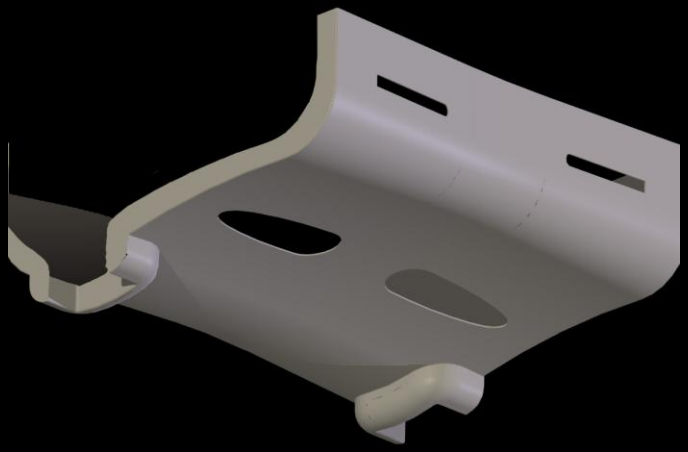


ABS panels

The panels have to be mounted on the side wall and roof so as to cover the duct network and insulated wiring channels



Selected Concept

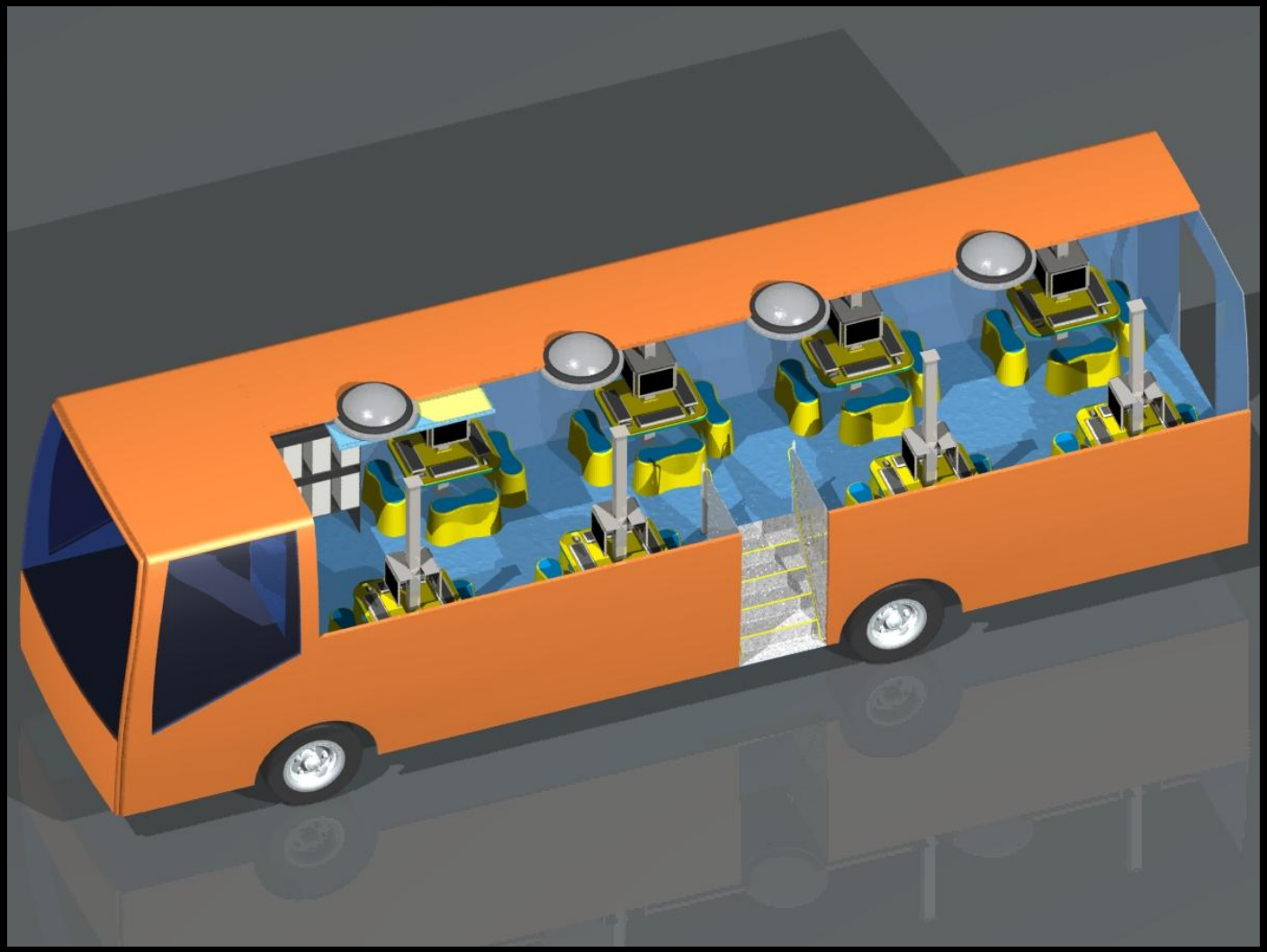


ABS panels for covering the a/c duct and wiring pipes

The panels have to be mounted on the roof and will cover the a/c duct as well as the wire carrying pipes, interconnected to workstation poles.

This concept was selected due to its playful form and modularity. It also provides smart space for placing the artificial light sources; as the junction of two panels is used for pillar and lights alternately.

Computer Bus



Layout Old layout

Exterior graphics

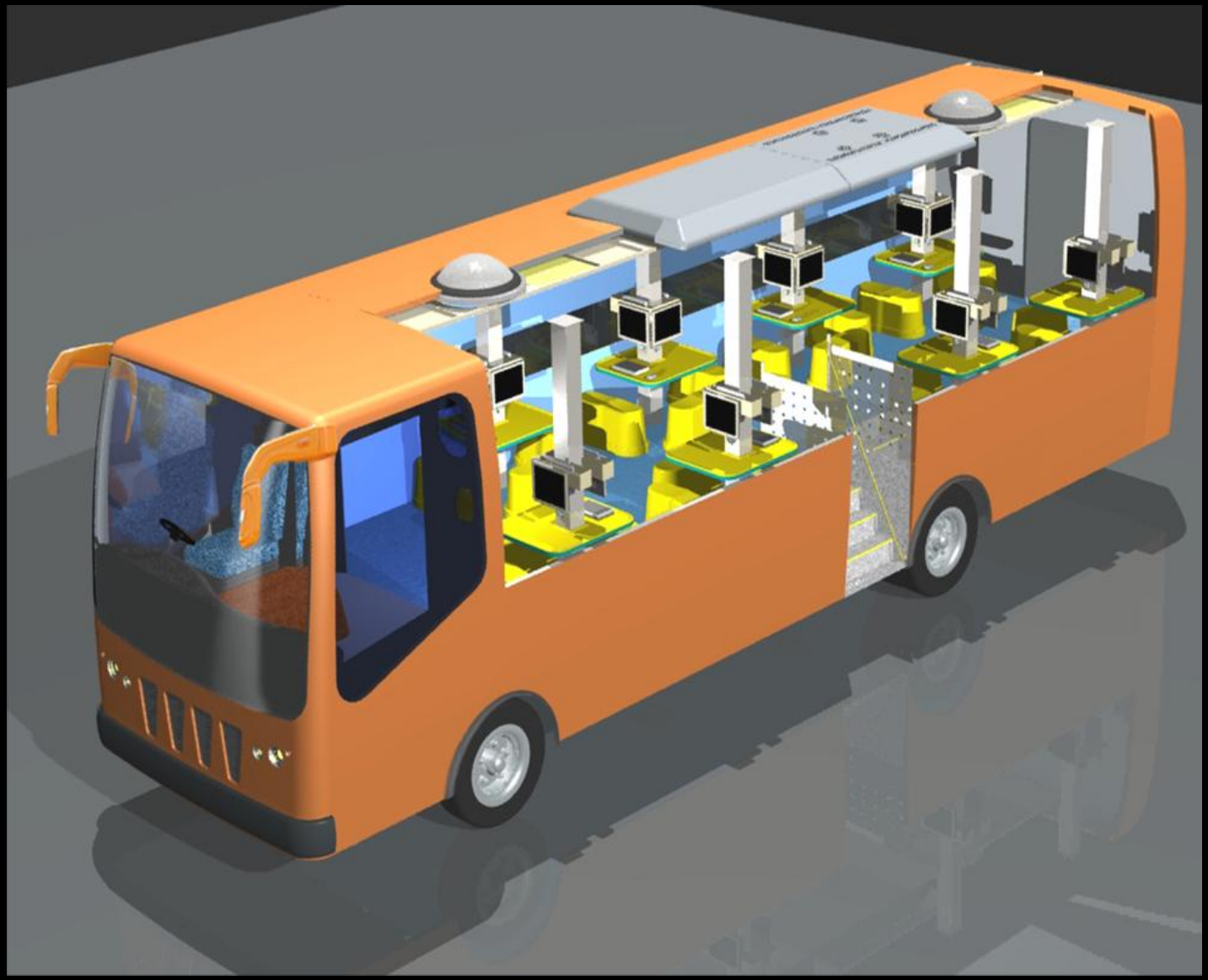
Theme of paw of a lion was taken for the windows

Theme taken was of windows of the home

Theme was of jungle with snake crawling on a stick

Theme taken was of water droplets splashed

Final Design renderings



Selected exteriors /graphics

exterior & graphics

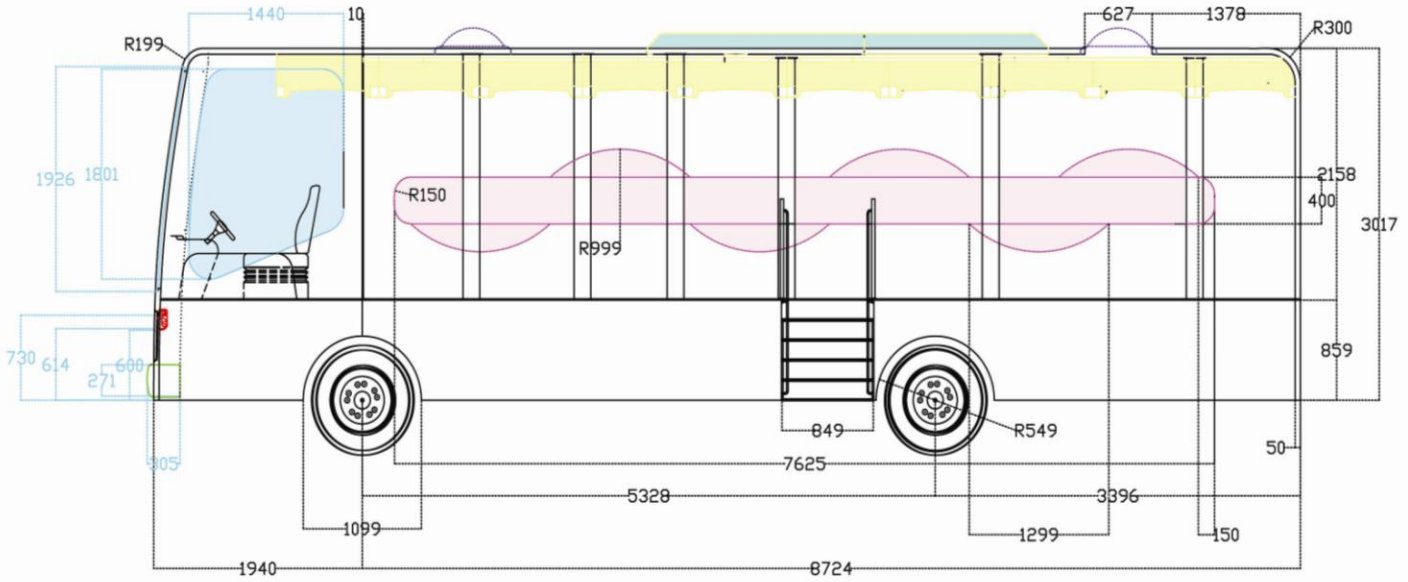
Product Model

exterior & graphics

exterior & graphics

2-D Drawing details

Side view: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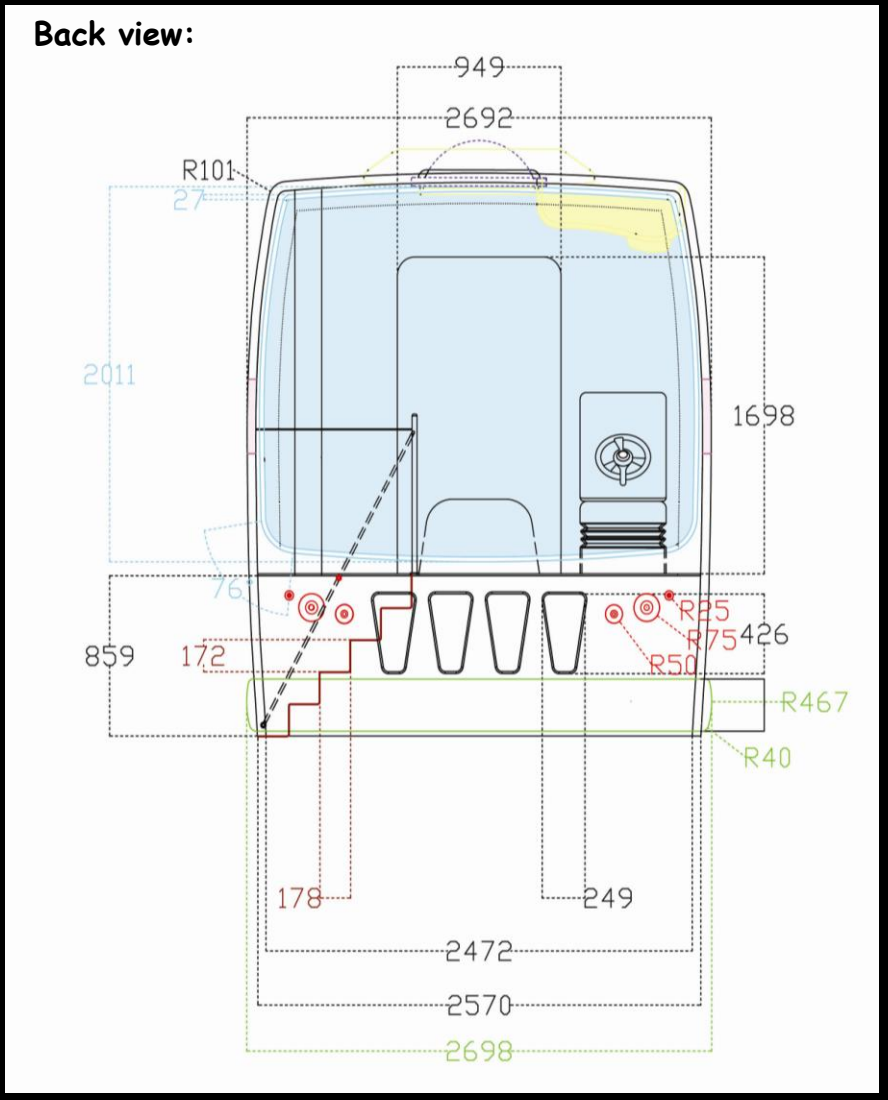
Back view: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