

Design Project 2

Designing new experience of next-gen tourist houseboat for Kerala backwaters

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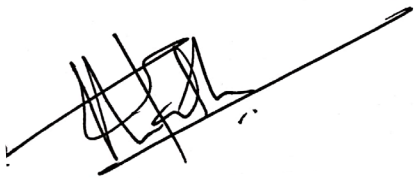
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DECLARATION

I declare that this written report represents my own idea in my own words, and where others' ideas or words have been included, I have mentioned the original source.

I also declare that I have adhered to all principles of academic honesty and integrity and have not falsified, misinterpreted or fabricated any idea, data, facts or source in my submission.

I understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the source from which proper permission has not been taken, or improperly cited.

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Niketh SJ

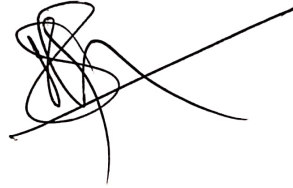
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Mobility & Vehicle Design 2017-19

APPROVAL SHEET

This Mobility & Vehicle Design project report entitled “Designing new experience of next-gen tourist houseboat for Kerala backwaters”, by Niketh SJ is approved in partial fulfillment of the requirement for Master of Design degree in Mobility and Vehicle Design.

Guide : Prof. Nishant Sharma



Examiners :

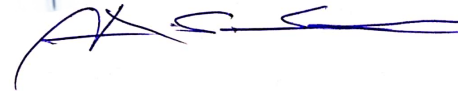
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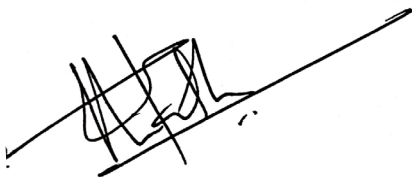
This project would not have been possible without the help from a number of people, and I would like to express my sincere gratitude to them.

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Finally I am thankful to IDC for providing all the necessary facilities and infrastructure for me to carry out the project.

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ABSTRACT

The state of Kerala has an extensive network of backwaters which has been used for transport and tourism for decades. An image which pops into our heads when we hear backwater tourism is that of a traditional Kerala houseboat sailing through a serene and rich environment. This calming experience is destroyed by the noise and vibration caused by the diesel engines. Along with this discomfort, it also causes high levels of air and water pollution.

This project deals with designing a new experience for houseboat tourists providing them with an array of luxurious spaces by which they can enjoy the serene scenic beauty without any disturbance and providing an alternative to conventional diesel powered houseboats. For this purpose, an extensive user research was done along with a co-design process to figure out the latent needs of the users. The insights from this exercise led to developing spaces for activities and experiences within the boat. The planning and layout of the boat was inspired by traditional Kerala architecture, & art forms. These layouts were evaluated by users on certain criteria and the most appealing one was further developed.

The design features next-gen solar panel and battery systems which are much more efficient than conventional ones thereby discarding the conventional diesel engine system. An in-depth research of the evolution of houseboats and subsequent form development led to the design of exteriors which drew its inspiration from the festivals and art forms of Kerala.

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1. PROJECT BACKGROUND

The state of Kerala has an extensive network of backwaters which has been used for transport and tourism for decades.

An image which pops into our heads when we hear backwater tourism is that of a traditional Kerala houseboat sailing through a serene and rich environment. But, the major issue which breaks the calmness of this leisure trip is the noise and vibration caused by the diesel engines. Along with this discomfort, it also causes high levels of air and water pollution. This problem of pollution can be tackled by introducing a solar powered system into the equation.

Simply attaching solar panels to the existing houseboats would make them appear completely out of place. Hence, a new array of Kerala houseboats have to be designed which has an integrated solar power system, while retaining the design language and integrity of traditional Kerala boat designs.

The primary users of this service would be tourists, both domestic and international. Alleppey attracted around 75000 foreign and 4.3lakh domestic tourists in 2017, and this number is rising annually (Kerala Tourism Statistics - 2017, keralatourism.org). With this rising population, demand for backwater tourism activities will also be on the rise, which would mean more houseboat trips.

Hence, if a houseboat which runs on clean energy is introduced, it can curb the potential damage which could be caused by pollution of houseboats in such large numbers. The reduced vibration and noise would also give the tourists a much better leisure environment within the boat.

With the latest advancements in clean energy technology, there are several facets which can be explored. With integrating such a modern concept into traditional houseboats, its sure to attract more tourists to enjoy the calm and pollution free atmosphere provided. Furthermore, this system can be adapted into smaller traditional vessels in Kerala.

2. RESEARCH

There is requirement of a multifaceted research for this particular project as it not only deals with the physical form of the product but also the experience which it offers the user - as user is contained within the product.

2.1 Preliminary research

2.1.a THE KERALA BACKWATERS

The Kerala backwaters are a chain of brackish lagoons and lakes lying parallel to the Arabian Sea coast (known as the Malabar Coast) of Kerala state in southern India. The network includes 5 large lakes linked by canals, both man made and natural, fed by 38 rivers, and extending virtually half the length of Kerala state. The backwaters were formed by the action of waves and shore currents creating low barrier islands across the mouths of the many rivers flowing down from the Western Ghats range.

The Kerala Backwaters are a network of interconnected canals, rivers, lakes and inlets, a labyrinthine system formed by more than 900 km of waterways, and sometimes compared to the American Bayou. In the midst of this landscape there are a number of towns and cities, which serve as the starting and end points of backwater cruises. National Waterway 3 from Kollam to Kottapuram, covers a distance of 205 km and runs almost parallel to the coastline of southern Kerala facilitating both cargo movement and backwater tourism. Most of the rivers are navigable up to the midland region, in country crafts.

The backwaters have a unique ecosystem: freshwater from the rivers meets the seawater from the Arabian Sea. A barrage has been built near Thanneermukkom, so salt water from the sea is prevented from entering the deep inside, keeping the fresh water intact. Such fresh water is extensively used for irrigation purposes. Many unique species of aquatic life including crabs, frogs and mud-skippers, water birds such as terns, kingfishers, darters and cormorants, and animals such as otters and turtles live in and alongside the backwaters. Palm trees, pandanus shrubs, various leafy plants, and bushes grow alongside the backwaters, providing a green hue to the surrounding landscape. (Kerala backwaters, [wikipedia.org](https://en.wikipedia.org/wiki/Kerala_Backwaters))



Img 1. Map of Kerala Backwaters

2.1.b BACKWATER TOURISM

Backwaters is one of the major tourism product of Kerala, being unique to the state. Traditionally used as one of the main transportation alleys, today backwaters offer a rejuvenating experience for tourists visiting Kerala.

The backwaters can be explored by hiring a boat for one or several days. If you go for more than a day, the boat usually comes with a navigator and a cook, which provide you with various facilities when exploring the backwaters.

While hill resorts and beaches can be found in other parts of India, the backwaters are unique to Kerala. Meandering through the coastal areas of Kerala is a 900 kilometers (560 miles) long intricate network of lagoons, lakes, canals, estuaries and deltas of several rivers that flow into the Arabian Sea. This is a natural phenomenon, as major rivers and streams that flows within Kerala drain themselves into backwaters regions, resulting in creation of several small land strips, lagoons, islands etc, which opens to sea at few areas. Thus backwaters are one of the largest fresh-water sources and rich in marine habitat as well as adds to natural beauty. Kerala has 3 backwater regions. (Kerala backwaters,[wikipedia.org](https://en.wikipedia.org/wiki/Kerala_backwaters))

Aleppey, with its Vembanad lake is the prime centre of backwater tourism. It attracted around 75000 foreign and 4.3lakh domestic tourists in 2017, and this number is rising annually (Kerala Tourism Statistics - 2017, keralatourism.org).

Traditional Kerala houseboats is the main focus of tourism in these parts. People come from far and wide to spend a day away from the city and totally unwind in the serene locations the backwaters offer.



Img 2. Houseboat cruising through Kerala backwaters



Img 3. Local residents in a traditional boat watching houseboats

2.1.c KERALA HOUSEBOATS

Kerala houseboats initially were not used as tourist vessels. Instead, they were used to carry cargo from one point to the other via backwaters. These boats, usually were 100ft long with approximately 13ft wide in the middle. They were made using a special technique which gave them the name 'kettuvallam'. The wood (mainly Jungle jack) were tied together using coir and then a resin made from boiled cashew kernels was coated on the surface for water proofing and protection. This meant that not a single nail or rivet was used in the construction of the boats.

The earlier boats were punt driven and was used to carry rice or other cargo. Once the road network developed, use of kettuvallams for transport slowly died out. In the late 18th century, these boats evolved into residential quarters for people who didn't own land. It was brought into tourism by Mr Babu Varghese during 1991-92. Since then, houseboats have been an integral part of Kerala tourism.

Presently, houseboats feature diesel engines and include all modern facilities - air conditioned bedrooms, toilets, kitchens, etc. By 2015, there were 740 registered houseboats and 500 unregistered ones functioning in the Alleppey-Kumarakam area. These boats are mainly used as an escape from work and city life. Tourists rent out boats for a day or two, cruise the backwaters and return refreshed and rejuvenated.

Due to the ever increasing number of boats and tourists, the whole area is adversely affected as the diesel engines cause huge amounts of water, air and noise pollution. Locals have reported that many fish species have disappeared after the tourism boom which happened. This sort of pollution coupled with vibration also reduces the quality of experience houseboats offer. Hence, there is a scope for intervention here, to come up with a cleaner, more silent solution, which offers a better wholesome experience of the backwaters.



Img 4. A double decker Kerala houseboat



Img 5. Typical interior of a Kerala houseboat

2.1.d HOUSEBOATS AROUND THE WORLD

Due to rising land price and unavailability of land, many are choosing to live in houseboats or barges. This phenomenon is occurring across mainly in Europe. Majority of houseboats are moored and are not used for travel or leisure purpose, but as permanent homes.

The ones being marketed as tourist boats are mainly floating hotels which look like buildings mounted on hulls or barges. Such moving leisure houseboats exist in Zimbabwe, USA, Canada and Australia and are used mainly for recreational activities or overnight stays. The tourism activities are primarily related to canals, historical spots, lakes and national parks. They include activities like fishing, sightseeing, etc

There is no particular design language followed in any of these boats. They mostly look like contemporary houses mounted atop floats. There are a few exceptions where these boats have been styled like modern yachts.



Img 6. Houseboats in Amsterdam



Img 7. Houseboat in Zimbabwe



Img 8. Houseboat in USA

2.2 Form study of Kerala houseboats

2.2.a HISTORY

The present Kerala houseboat designs can be traced back to sewn boats developed in 3000 BC. These were known as 'kevuallam' - A type of kettuvallam. A huge lot of similarities can be found between these boats and traditional Egyptian sewn vessels which also date back to roughly 3000 BC. These vessels are known to have evolved from papyrus boats. This influence may have come about due to trade relations which existed strongly between these two regions during those times.

The technology used in somewhat similar in both types of boats. Instead of nailing planks together, they have been sewn together. This reduces the risk of rusted nails causing wear and tear to the boat. This method also reduced the cost of production drastically.

The first type of kettuvallams were used to transport cargo and goods to locations which were inaccessible by roads. The smaller ones were also used for ferrying people as well as for fishing activities (CEAlexandrie, 2013)



Img 9. Ancient Egyptian papyrus boat



Img 10. Ancient Khufu boat



Img 11. Details of Egyptian sewn boat



Img 12. Details of Kevuallam in Kerala

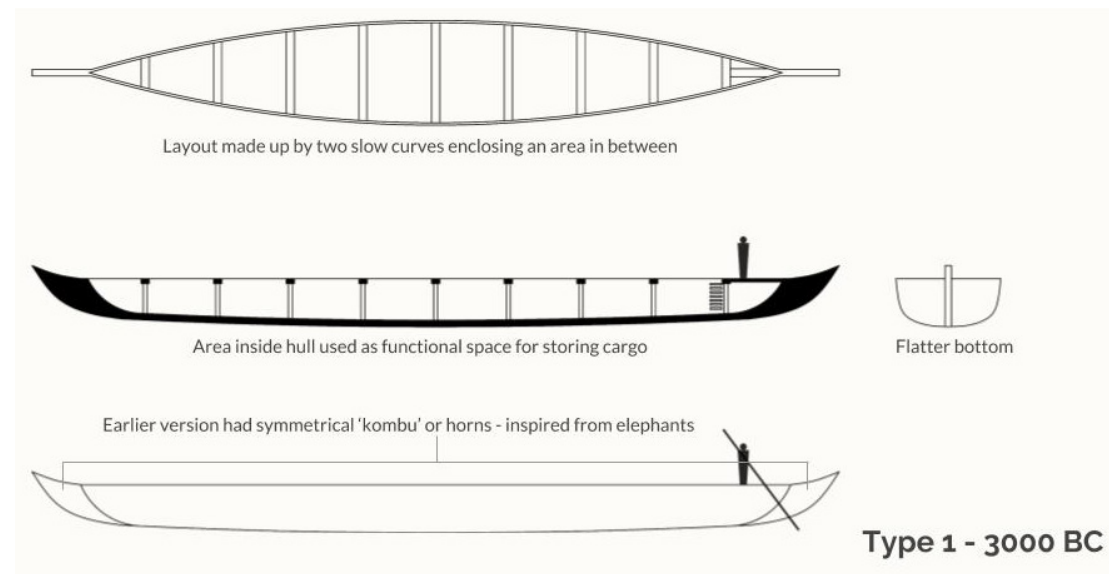


Img 13. Traditional Kerala kettuvallam

2.2.b EVOLUTION OF KERALA HOUSEBOATS

Type 1 - 3000BC

Kevuvallam is the first type of kettuvallam which was introduced. Its in use even today. Locally available Anjili wood has been used for the construction of this boat. Wooden members are tied together using coir ropes, gaps filled using coir and then coated with a resin made from boiled cashew kernels. These boats reach a maximum size of 100 ft in length and are 13 ft wide in the middle. They were primarily constructed to carry cargo and could be loaded up to 30 tons in weight. These were punt driven and accompanied by one or two drivers.



Img 18. Schematic diagrams of kevuvallam



Img 14. A traditional kevuvallam retrofitted with an outboard motor



Img 15, 16. Details of kevuvallam. Sewing patterns can be seen

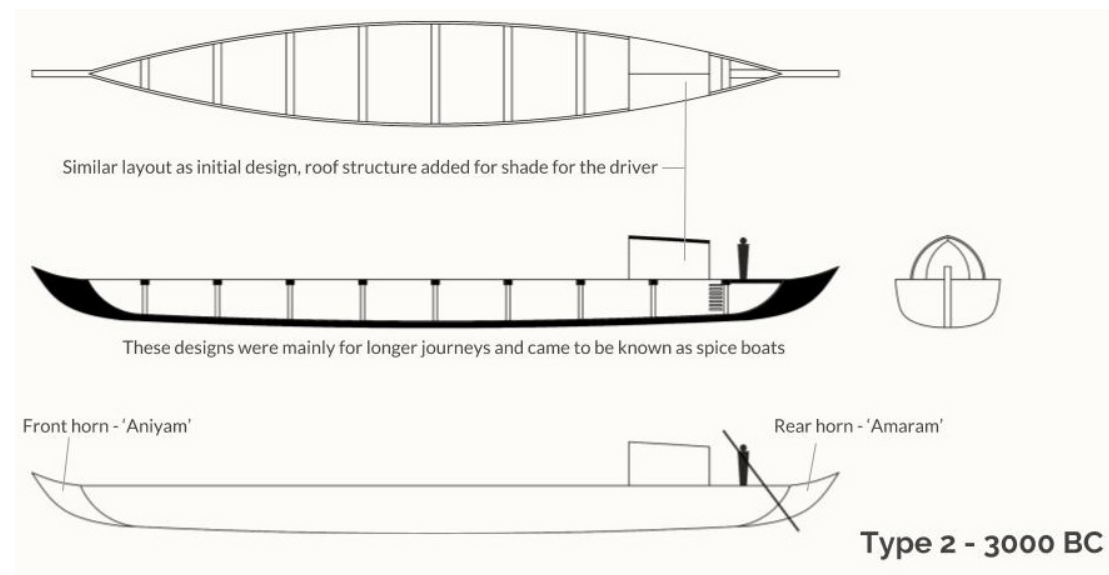


Img 17. Ribs which hold the basic structure of the boat together

Type 2 - 3000BC

The second type is a slightly modified version of the kevuallam. The boats travelling longer distances, taking longer duration to reach its destination required a small space for the driver to rest in. Hence a small roof structure was added onto one end of the boat near where the driver used the punt. These were the initial 'spice boats' which generally carried precious cargo or spices from inland to ports and vice versa.

The roof structure is made from woven bamboo/coconut mats. The structure comprises of arched bamboo members.

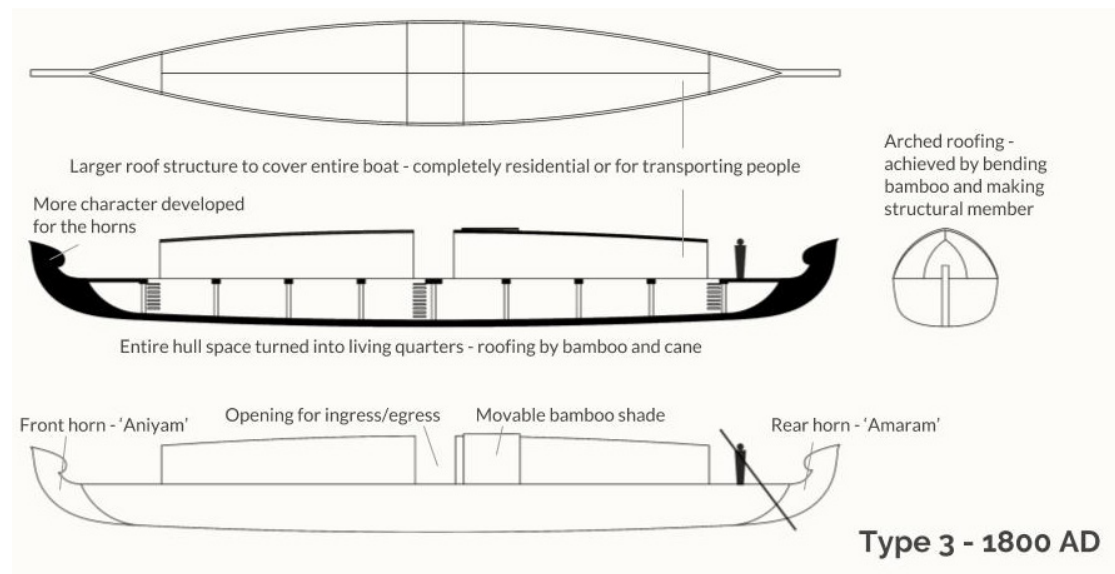


Img 19. Schematic diagrams of kevuallam. The roof has begun its evolution

Type 3 - 1800AD

The form started taking shape into a house boat by 1800. Due to development of roadways and improved connectivity, cargo was transported via road. The backwaters became a way of transportation for people. Due to various social difficulties, there were numerous families which didn't own any land. Such people resorted to developing the kettuvallam as a permanent residence. They moved around from time to time using backwaters and rivers.

The hull of the boat became living quarters. A prominent roof system evolved which was used as protection for the entire hull. The roof system made with bamboo shoots as structural support, bamboo mat, coir ropes, etc



Img 22. Schematic diagrams of kettuvallam. The roof covers the entire hull area



Img 20. Kevuvallams transformed into houseboats being docked in waterways



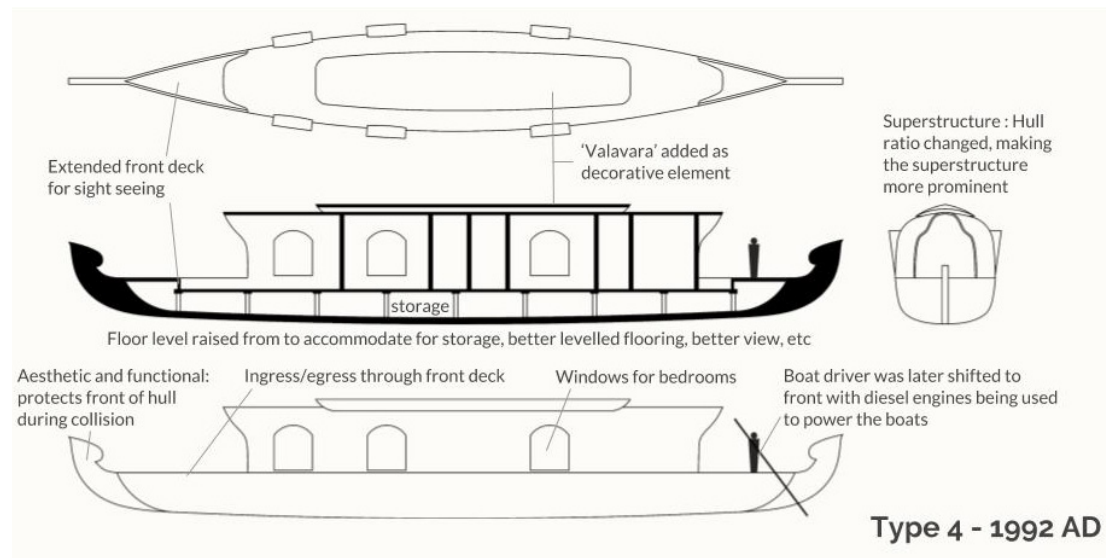
Img 21. A typical kettuvallam

Type 4 - 1992 AD

Houseboats started dying out by late 1800s. This is when an entrepreneur named Mr. Babu Varghese came up with a proposal to use houseboats as a tourism venture. His proposal was accepted by the authorities and hence the first set of tourist houseboats were born.

For this, the traditional vessels were modified quite a bit. The entire floor was raised and the hull space was used for storage and for waste collection. The interiors were redesigned in a hotel style. Bedrooms, toilet, and kitchen was introduced as separated out spaces. Wood was used extensively in the interiors.

Initially the boats were driven by long poles known as punts. Later outboard engines started came up and were retrofitted on the hulls. A few years later, inboard engines were incorporated into the hull space. The hull space was further divided for storage of fuel.



Img 25. Schematic diagrams of initial tourist houseboats



Img 23. Modern kettuvallams which were used as tourist houseboats



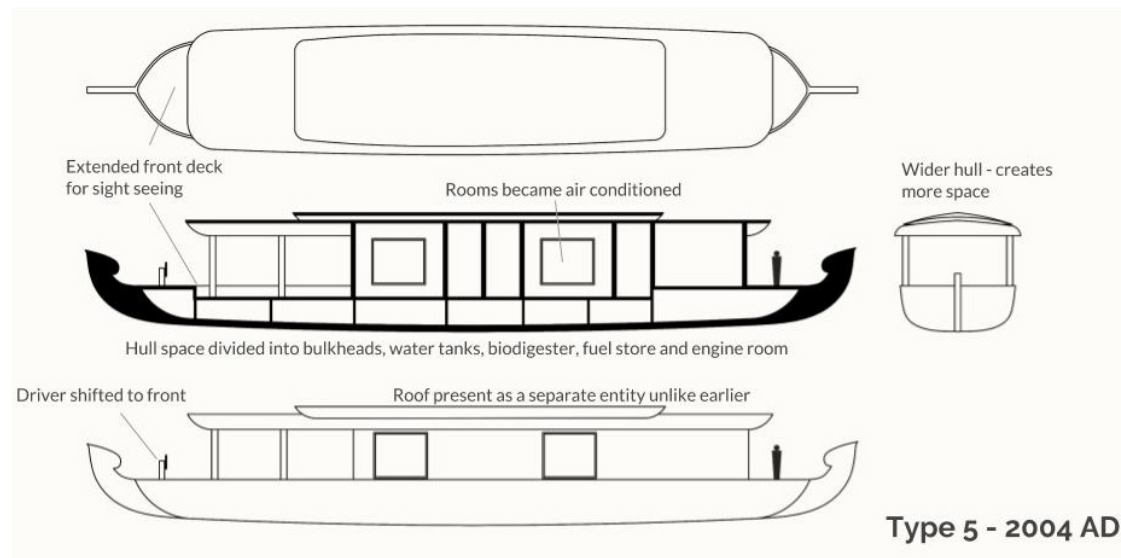
Img 24. A typical tourist houseboat. The driver can be seen with the punt

Type 5 - 2004 AD

By 2004 a new array of houseboats were launched. They featured iron hull instead of the traditional wooden hulls. The main reasons behind this was unavailability of skilled labour to manufacture and maintain wooden hulls. Manufacture of iron hulls were also less time consuming and they required less maintenance in comparison with wooden hulls. The process was much more of an industrial method and not craft.

These boats further evolved when FRP hulls started coming into the picture. FRP hull production required even lesser time and also was much more economical than iron hulls. The huge weight reduction also meant that transportation of boats from production yards to backwaters were easier.

The boats started becoming air-conditioned. The features started becoming more and more luxurious. Samudra Shipyard Pvt Ltd were the pioneers in FRP hull technology. They divided hulls into bulkheads, storage space, waste collection chamber, fresh water tanks, etc. Subsequently the boats grew wider and started featuring more bedrooms.



Img 27. Schematic diagrams of modern tourist houseboats



Img 26. Modern houseboats which feature iron hulls

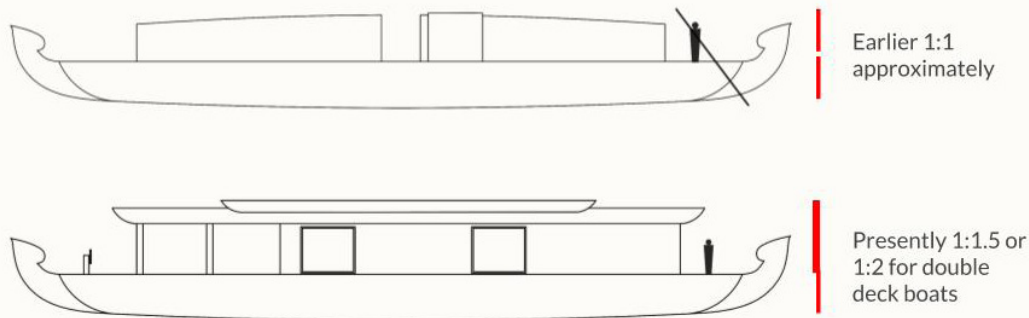
The double decker

The boats underwent further evolution when an additional deck was added on as an upper level. In the initial boats featuring upper decks, these were open spaces which were used as a viewing deck or as a dining space. Further, this space also became air conditioned and bedrooms were added on these upper decks. Form-wise, the primary change that occurred was that the entire roof was either lifted or expanded based on the extent of the deck provided.

Proportions

The major change which we can observe from the initial design is that due to the floor height being lifted, the height of the superstructure has increased. This caused the entire roof to be lifted up.

Proportions - Changed over time



Img 32. Change in proportions between old and new houseboats

Characteristics and symbolism

The one major characteristic or rather metaphor we can observe from houseboats is the visual reference it has taken from elephants. The Asian elephant is used quite a lot for temple festivals in Kerala. The colour and certain features have come about based on this inspiration. The traditional 'kompu' or the horn used to be plain and functional. Later in time, it evolved and started showing certain masculine and feminine characters. The masculine version often included a pointy outward horn which showed a dominating and strong nature. The feminine version had a curled up horn which showed a more timid and submissive character. These were developed based on the trunks and tusks of the elephant.



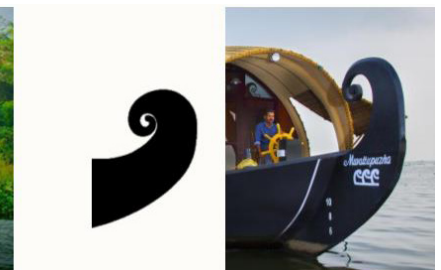
Img 28. Houseboat with an upper deck



Img 29. Houseboat with a large upper deck serving as a banquet space



Img 30. Masculine character of horn



Img 31. Feminine character of horn

Evolution of Materials

The initial houseboats used completely indigenous materials. Hulls were made out of wood, bound by coir, coated with boiled cashew resin. The roofing was made out of woven bamboo or palm leaf mats. The supporting structure of the roof was made out of bamboo. The entire boat was made out of eco-friendly materials.

As the boat evolved, the materials used also changed. The latest version of houseboats feature FRP hulls. The superstructure is made from numerous materials. The support structures are frames made from wood or steel. The walls which come up between these frames are made from marine grade plywood. This plywood is either plastered and painted or is clad using tiles, wood or other materials based on the interior design theme. The floor is either wooden cladding or tiled. Glass is used in plenty for the door and window openings. The false ceiling is also made from marine grade plywood. The roof is made using woven bamboo or palm leaf mats, but they have an additional layer of water proofing material (plastic sheets are used) sandwiched between layers. Wood is used in plenty for decorative features.

2.2.c INFLUENCING FACTORS

Throughout the years, there have been a few major factors which has influenced the design of houseboats.

Traditional Architecture

The heavy use of wood and roofing techniques have been sampled from traditional Kerala buildings. The earlier proportions were also similar to traditional Kerala residential buildings. Presently, the architecture has moved into much more modern and contemporary style. This has also affected the design of interior of the boats. The boat interiors are being styled like modern residential and resort interiors with the same provisions such residences and resorts provide.

Climate

The roof evolved as a response to the climate of the region. Kerala has a tropical monsoon climate and therefore faces heavy seasonal rains. This gave birth to sloping roofs and extended eaves. The extended eaves also helped in providing shade from the sun.

Materials

Indigenous materials were used in the initial boats. Materials like bamboo, wood, woven mats, etc presented limitation in the form which could be achieved. The use of these materials were also skill dependant. Materials which could resist the climate were chosen for making boats. Presently the material palette has changed a lot. But even then, there is a particular style in which the boats are designed. There has been very less deviation from the original form of houseboats.

In the present context, use of latest and modern materials can offer a much efficient design solution than sticking to indigenous materials. The older materials are highly skill dependant and also require heavy maintenance.

Construction technology

Earlier boat design used to be a craft which was passed on from generation to generation. This had huge impact in the way boats were designed. As time passed, with arrival of better technology in the construction field, the form of boats have changed. Presently much more industrial methods are used for construction of boats. This is not craft dependant and is less time consuming.

Residential building methods like framed structures, cladding, tiling, false ceiling, etc are prominent features of house boats now.

Function

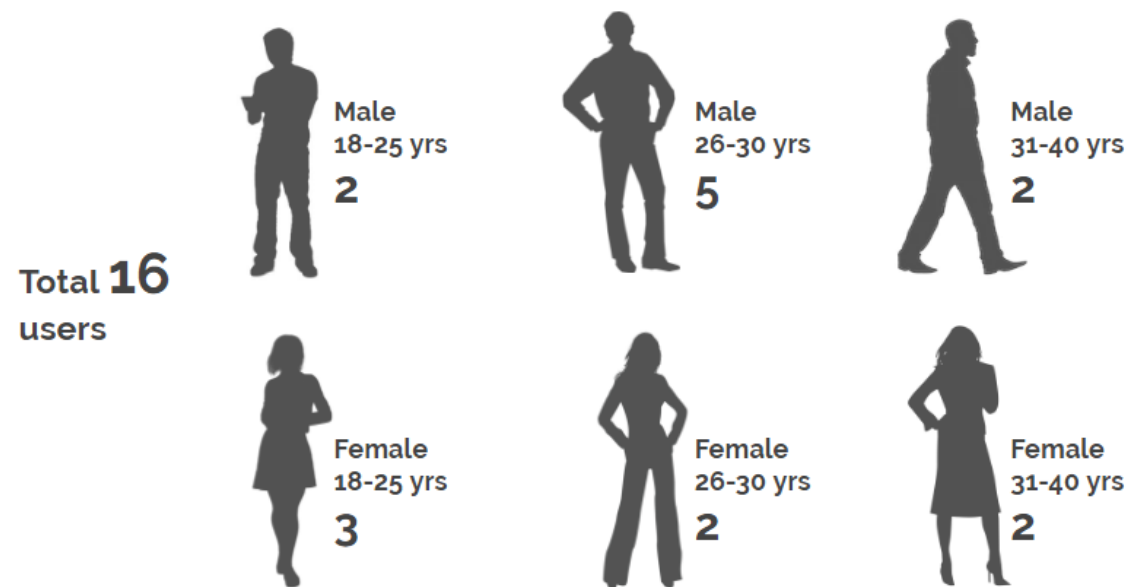
The form has been influenced a great deal by the function of boats. Earlier, when boats used to be just cargo carriers, they didn't have roofs. When there was a need to give a quarters for the driver, the roof came into play as a protection from rain and sun. Once the boats developed as completely residential in function, the roof grew to cover the entire hull portion. This is the form which has been most influential throughout houseboat design history.

Present boats which are designed for tourist purposes have a much more prominent superstructure and have developed windows and decks to allow the tourists to enjoy views. With requirement of an upper deck to include more bedrooms and additional spaces, there has been further changes in form.

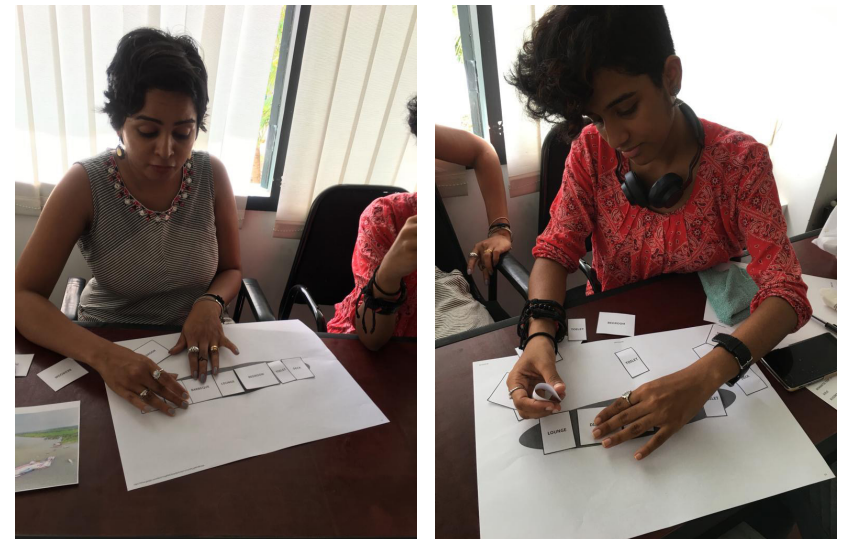
2.3 User research - Results & Analysis

There were a total 16 users who participated in the activity and they were targeted based on certain criteria. This included male and female users from different age groups - 18 to 25, 26 to 30 and 31 to 40. A spectrum like this would help us identify the aspirations of different age groups, and help us understand their priorities when it comes to enjoying holidays.

2.3.a PART A - BASIC INFO



Img 32. User demography



Img 33-36. Users participating in the activity

2.3.b PART C - TASK 1

“If you’re spending a holiday here, who would you like it to be with?”

Family

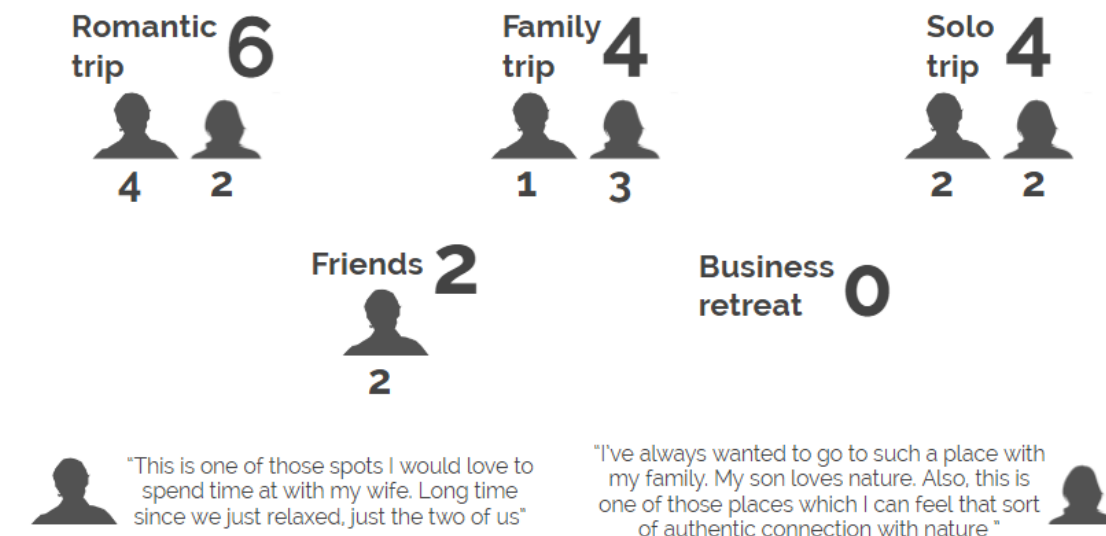
Friends

Romantic trip

Solo

Business retreat

It was observed that users belonging to the age group of 18-25 preferred solo trips, 26-30 preferred trips with friends or romantic trips, and ages 31-40 preferred family trips. Female participants preferred romantic trips over trips with friends or solo trips. Out of all the participants, majority related the location with romantic trips.



Img 37. Travel preferences of users

“Pick a spot where you’d like to spend maximum time in this setting”

An image showing the prime location of backwater tourism in Alleppey is shown to them and they are asked to pick a spot where they’d like to spend maximum time at. This will give us a clue as to whether the user prefers a completely isolated setting, or one which has proximity to land, or one in which he has other tourists for company.



"The location looks interesting. I want to spend my time closer to the mainland, but enough far off so that I can enjoy the houseboat ride"

"I want it to be closer to mainland, but it should afford view of waterways on three sides and paddy fields on one side "



Img 38. Location preferences of users

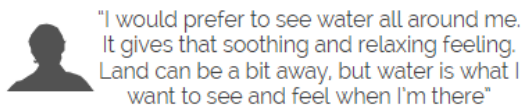
In this task, the results showed that most spots were chosen nearer to the land. This shows that although users want a feeling of calmness and solitude, they want to be close to land, as they feel safer that way. This also gives out an idea of how adventurous users would want to be in such a setting.

2.3.c PART C - TASK 2

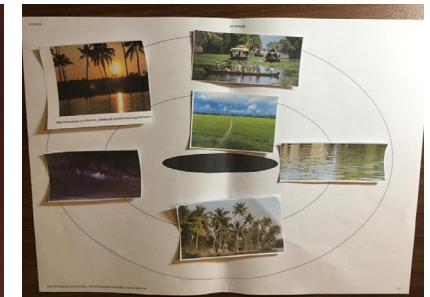
“Pick and place the views you want to see from you boat”

In this task, a diagram with the symbolic image of a boat is given with 3 concentric rings depicting proximity to the boat. A set of 7 images are given to the user. These images feature the primary views which are available in the backwater setting. The task for the user is to arrange these views in the boat diagram based on the proximity - physical or visual, and general direction in which they want these views to be experienced from. It is not necessary for the users to pick all the view cards in this task. They can choose and prioritize on their own.

Majority of users want to be visually and physically close to water. In the second level of proximity, users included other houseboats too. This shows us that they don't want to be completely isolated. Views of land and local architecture fall into the 3rd level, which shows that users do not really associate such a holiday experience with land related activities.



"Having nature all around is what I would prefer. It'd be wonderful if I can see such sunrises and sunsets every single day"

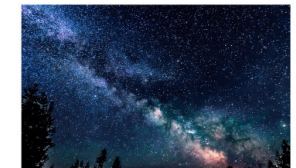
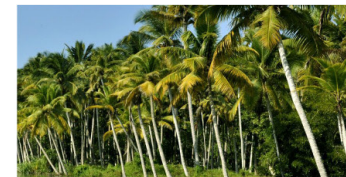
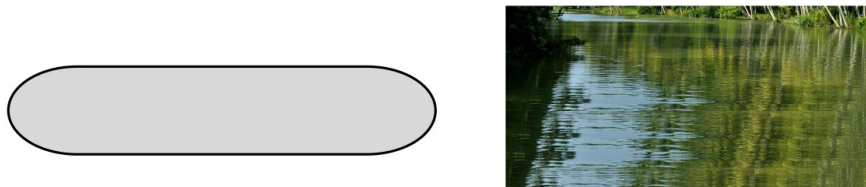


Img 39-40. View preferences of users - artefacts

Level 1

Level 2

Level 3



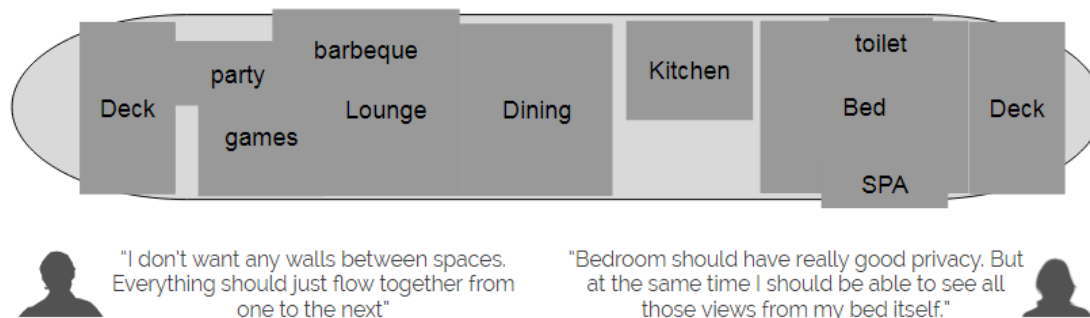
Img 41. View preferences of users - results

2.3.d PART C - TASK 3

“Pick spaces which you would want on your boat and place them”

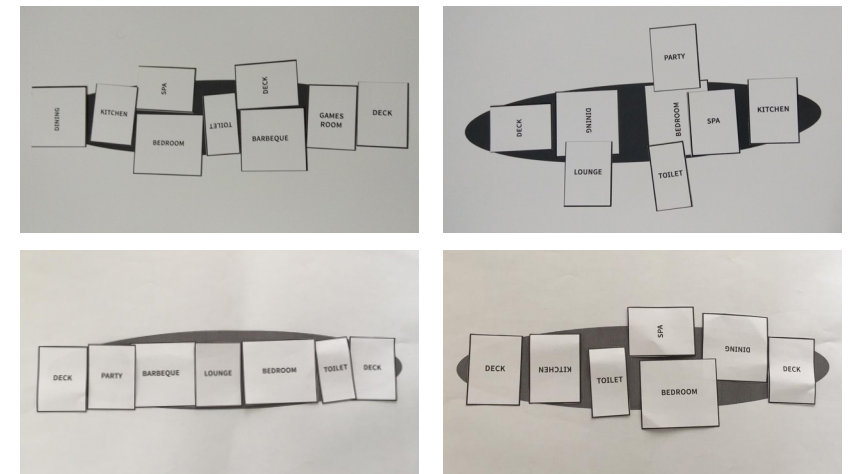
A diagram showing the schematic plan of a boat is given along with cards with various spaces written on it. The task of the user is to pick out spaces which he finds relevant in his boat and to set them based on where he needs those spaces to be.

While setting up the spaces, the user will inadvertently arrange them based on the primary experience he wants.



Img 42. Space preferences of users - results

It was observed that majority of users want to have open viewing spaces at both ends of the boat, with decks. The existing structure of boats feature bedrooms in the middle, whereas users prefer bedrooms to be at the rear which gives them a completely private area at one end.



Img 43-46. Space preferences of users - artefacts

2.3.e PART C - TASK 4

“Select words which you would relate to while having such a vacation”

- | | | |
|---------------------|---------------------|--------------------|
| 1 Scenery | 3 Food | 6 Adventure |
| 2 Relaxation | 4 Explore | 7 Culture |
| | 5 Recreation | 8 Entertainment |
| | | 9 Guide |
| | | 10 Sharing |

It was seen that users are more interested in being relaxed and enjoying the sites than to pro-actively do adventurous activities.

Scenery



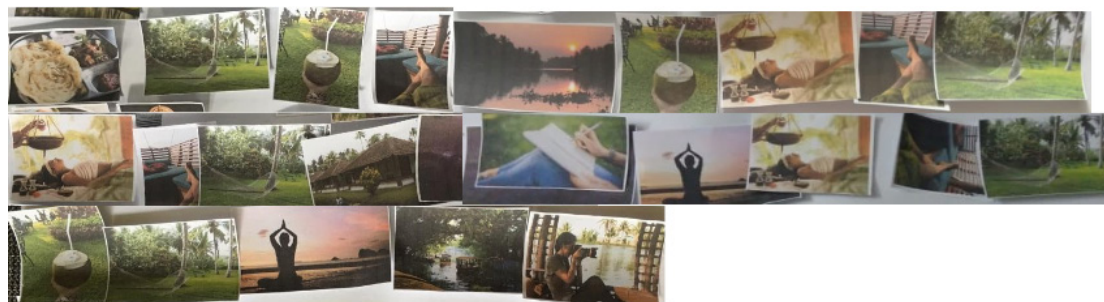
"This trip would be ideal if I could just relax, and take in all those views I get. I don't want to even get up from wherever I'll be lying"

"From what I've heard about the place, I don't think I'll be able to finish seeing the entire place in one go"



Img 47. Image selection for the word 'Scenery'

Relaxation



"I just want to forget about the rest of the world for sometime. If this place offers me such an experience, I'll be more than happy to do this every year"

"Is there anything other than relaxation which is to be done in such a place?"



Img 48. Image selection for the word 'Relaxation'

2.4 Technology

2.4.a AUTONOMOUS WATER TRANSPORT SYSTEMS

Considering a next-gen scenario, the introduction of autonomous systems are inevitable. How valid is it in a water transport scenario and how far has developments been made in this field to achieve autonomous water transport solutions has to be researched upon.

Seacharger

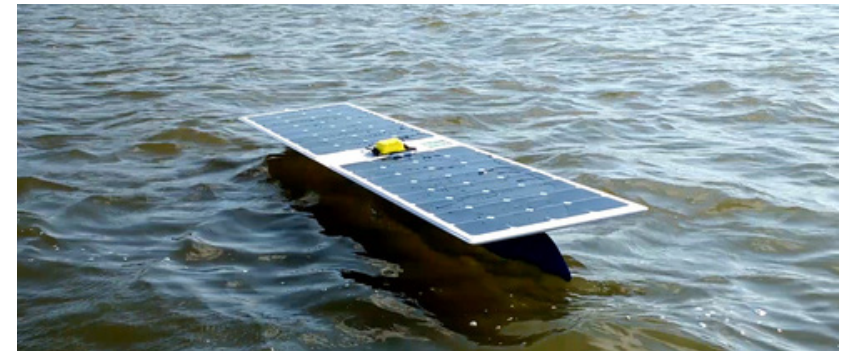
The 'Seacharger' is a solar powered, unmanned craft. It started off as a garage project by Damon McMillan. The device has completed a 2000 mile journey from California to Hawaii solely on solar power. The device is fitted with 2 PV panels and a LiFePo battery for storage. It measures 8ft by 2ft, is GPS guided and achieves an average speed of 2.43mph. (Ridden, Paul. 2016)

Autonomous Ferry System, Amsterdam

There is a proposal for starting autonomous ferry/boat system in Amsterdam and the project is being pursued by Amsterdam Institute for Advanced Metropolitan Solutions (AMS Institute), MIT, Delft University of Technology and Wageningen University and Research. The idea is to develop 3D printed boats that are sealed with FRP, which is self guided and capable of ferrying people through the canals of Amsterdam. It will have an integrated power supply, GPS, Wi-Fi antenna, minicomputer and a micro-controller to ensure proper functioning. The boat will span 4m by 2m and it is designed to self assemble into floating bridges, stages, platforms, etc. The final product is expected to be launched by 2019. (Robarts, Stu. 2016), (Matheson, Rob. 2018)

Autonaut

The 'Autonaut' is a wave powered, autonomous, unmanned craft. Its primary function is to monitor marine wildlife and ocean conditions using sensors which are solar powered. The vessel measures 7m by 1m and was designed and built by David Maclean & Mike Poole. The device is specially designed to use wave power to propel itself and can achieve a maximum speed of 5 knots. It can also house an auxiliary electric or hybrid drive, and a fuel cell as an alternative mode of propulsion. (Ridden, Paul. 2018)



Img 49. The Seacharger during its 2000 mile journey



Img 50, 51. Visualization of the proposed autonomous ferry system for Amsterdam



Img 52. The AutoNaut

Yara Birkeland

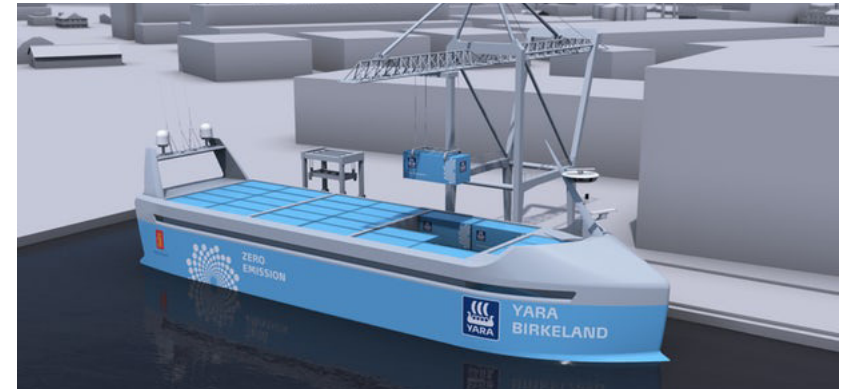
The 'Yara Birkeland' is an autonomous, all-electric shipping vessel developed by YARA, a Norwegian company and Kongsberg, a maritime technology company. The vessel will serve as a cargo transporter and will carry chemicals and fertilizers to Brevik and Larvik in Norway. The inspiration behind this venture was to reduce the NOx and CO2 emissions produced by cargo transport trucks. This huge 79.5m by 14.8 vessel is set to replace 40,000 truck journeys per year. It will achieve a speed of 6 knots and will be drawing power from 7-9 MWh batteries. The ship is proposed to operate as a manned vessel during its launch in 2018, achieve remote operability by 2019 and subsequently become fully autonomous by 2020. (Haridy, Rich. 2017)

2.4.b ARTIFICIAL INTELLIGENCE IN TOURISM

Artificial Intelligence is prevalent in different fields now. It has a huge potential when it comes to tourism. From deciding where to go on vacation, to setting up an itinerary can be managed by an AI without the user stressing too much. Such AI capabilities have been devised which reads users likes, dislikes, interests, etc and suggests possible tourist locations for visit, plans out sights to see, possible places he will enjoy dining, etc. With the introduction of personalised voice-based assistants, an entire vacation can be charted out just by giving basic info of the user.

Conversational digital interactions and emotional AI will play a big role in the coming years. By this, the AI will be able to read the emotions of the user through facial recognition and gesture recognition and respond accordingly. This will open a completely new door into the world of personalizing vacations, as the AI can read the mood of the user and suggest changes on the go. Along with this, social media can be used as another important guiding tool in the tourism industry. Social media listening bots can uncover sentiments, read interests and hobbies of the tourist and interventions based on that data or updates made by user can be made.

Hotel room / accommodation personalization is another experience which can be managed by AI systems. Based on user data collected while registering, the temperature, lighting, views via digital screens, etc all can be personalized for a user. Alterations can be based on the mood of the user or by the user communicating to the AI system. This will provide a much efficient method devoid of human error.



Img 53. Rendering of Yara Birkeland

2.4.c SMART HOME TECHNOLOGY

In the near future all of our homes will become 'smart'. This will feature a vast array of smart devices which are connected via IOT or Block-chain. These devices will communicate with each other as well as the user letting him know about daily usage and resource consumption. This will help minimize resource wastage, achieve maximum efficiency, monitor and help maintain health and comfort of user.

Most of the devices will feature proximity detectors for activation of devices. This trigger system will work only if the user is detected within a particular proximity. It can help reduce unnecessary consumption of power. Devices can also be assigned child lock features whereby safety is also ensured.

Systems like lighting and HVAC can be customized based on user needs. These systems will also continuously monitor the climate and weather conditions and function accordingly. For example, the windows can have smart shades or can have opacity control which will decide the light which is let through based on a pre-set value given by the user. This will ensure that daylight is used to its maximum extent and dependency on artificial lighting is reduced and help maximize energy efficiency.

Smart cooking systems can notify about nutritional value of food being prepared, and optimize it for the daily nutrition requirement of user. This will help reduce wastage of ingredients and also keeps the user aware and healthy. The system can cook for optimum duration to maintain maximum nutrition, consuming less power and other resources. It can be self cleaning, and will organize itself once the cooking activity is done

Smart toilets will have built in bio-digesters and systems to recycle grey water. There will be sensors to monitor health of the user. They can help minimize water use. These toilets will have a self sanitizing feature.

Beds which will adjust position to make the user comfortable, with features like foot-warmers, sleep tracking, aromatherapy and gentle wake up alarm. Smart blanket technology will ensure that a comfortable temperature is maintained within the blanketed area and will adjust accordingly if there is any climate change.



Img 54. Smart table project being developed by Ikea and Ideo



Img 55. Ideo project which deals with proper waste management in households



Img 56. Numerous companies have been working on Smart mirror technology



Img 57. Solar panels powering houses are evolving with improved aesthetics

Smart screens that can double up as mirrors, can be rolled or used as an active surface replacing top surfaces of tables, slabs, etc can offer a different experience to the user. Since all these systems will be connected together, he can use these surfaces as an interface to communicate with all devices.

All these features are no longer part of a fantasy. Companies like IDEO, Fraunhofer, Toto, Google are all working on technology that can make our homes much more smarter and efficient. Since technology is growing at an exponential rate, it'll be safe to say that within 10 years all this tech would become a reality

2.4.d CLEAN ENERGY TECHNOLOGY

The technology used in the field of alternative and renewable sources of energy has become advanced enough that we can completely forego fossil fuels. The field of solar power is being researched by the entire world as it is seen as the major source of renewable energy that we can obtain. Advancements in solar cell technology has led to development of new products like organic photovoltaics and bio-solar cells. These depend on completely biodegradable materials and also help convert solar rays into usable energy in an efficient manner. Organic PV cells and flexible and is biodegradable. Another interesting invention was the 'Solar window'. These solar cells are transparent and also serve purpose of a normal window. An organic liquid coating is responsible for this breakthrough invention.

When power generation is managed efficiently, power storage must also managed in an eco-friendly manner. Dual carbon batteries developed by Power Japan Plus, and Organic flow battery being developed and refined by MIT researchers show us that batteries can also be eco-friendly and biodegradable. The dual carbon battery has carbon anode & cathode, operates above 4V, charges 20 times faster than Li-ion batteries and are 100% recyclable. (Kite-Powell, Jennifer. 2014)



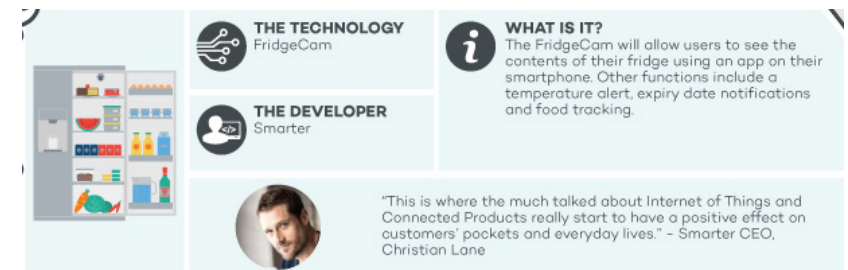
Img 58. Smart bed project which is being pursued by Sleep Number



Img 59. Smart toilets can solve the issue of excess water wastage by recycling



Img 60. Ovens that encourage intelligent cooking by optimizing power usage



Img 61. Devices which can help see whats in the refrigerator without opening it

3. DESIGN BRIEF

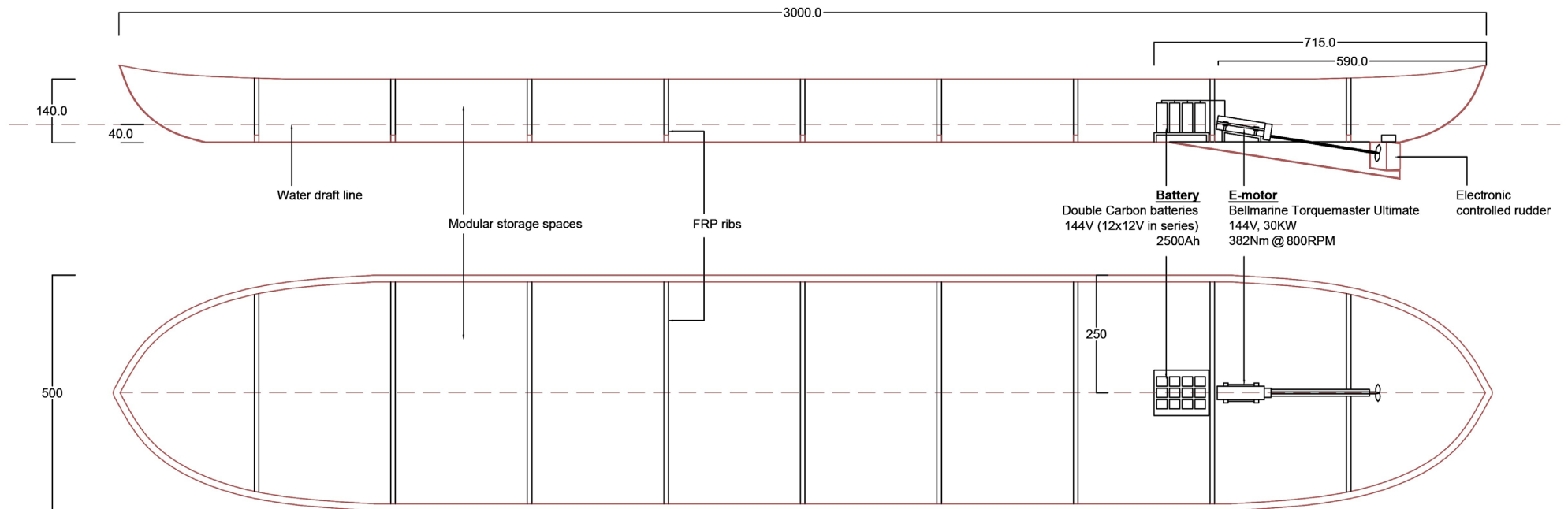
Design a next generation single bedroom houseboat for a family vacation in Kerala backwaters

The design should satisfy the following:

- **Main user group is couple tourists.** The spaces should satisfy the area requirements and meet standards of luxury houseboats - Bedroom (minimum 150sqft), lounge, viewing decks, dining space, kitchen, toilets (minimum 45sqft).
- The spaces designed should **enhance the overall experience** of the vacation - maximize views, relax & unwind
- The form design should **complement traditional Kerala houseboat designs** and at the same time **reflect modernity**
- Should also include service & storage spaces - Quarters for housing 2 staff members (driver, assistant/cook), water tank, sewage tank, grey water recyclers
- The boat will be based on an existing hull designed by Samudra Shipyard Pvt. Ltd.
30m long, 5m wide

4. PACKAGE DEVELOPMENT

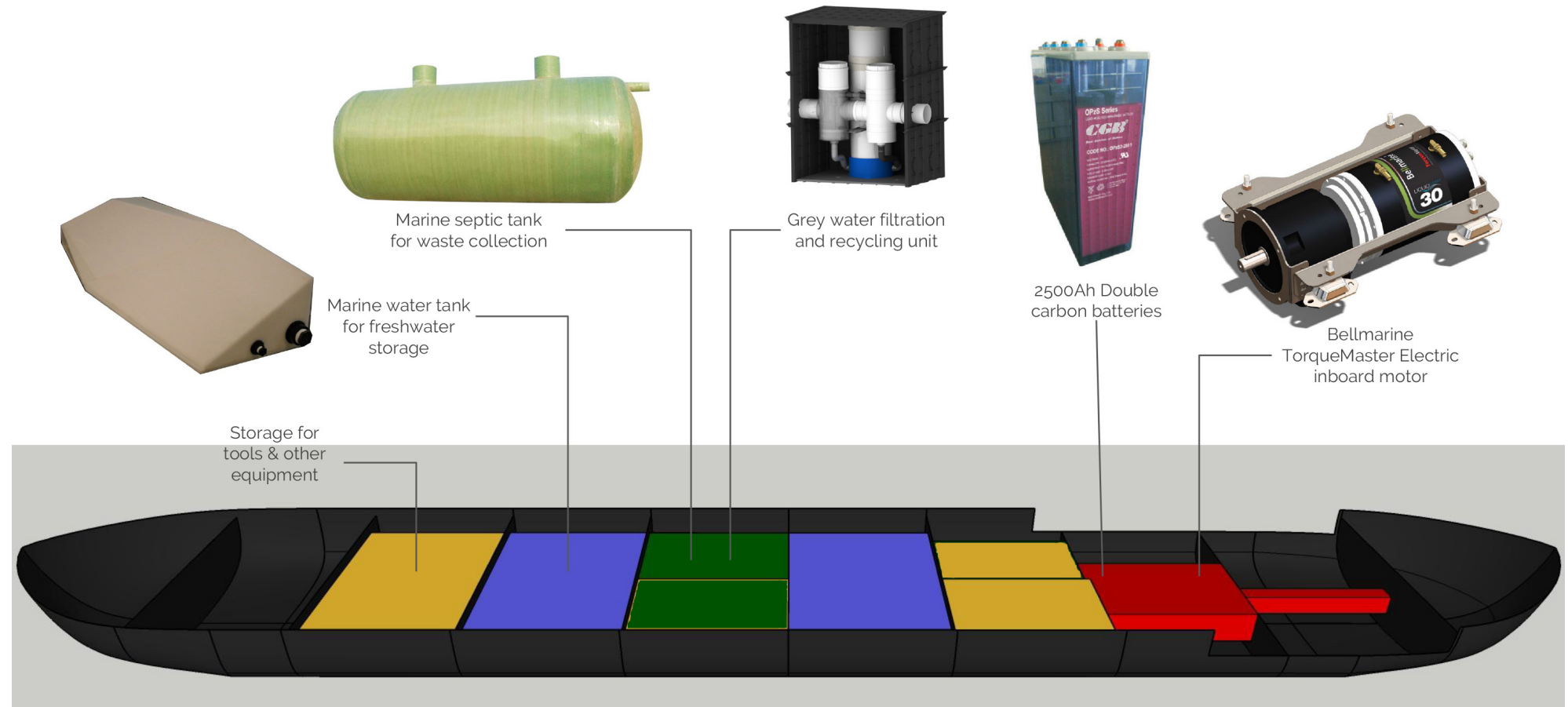
The package is based on a 30m long, 5m wide FRP hull designed and developed by Samudra Shipyard Pvt. Ltd. It will house 12, 12V batteries in series to generate 144V and has a nominal capacity of 2500Ah. This helps in running a 144V Bellmarine Torquemaster in-board electric motor which generates 382Nm @ 800RPM. It will have an electronically controlled drive system.



Img 62. Packaging drawing of the boat with battery and motor details

The compartments of the hull can be fitted with modular storage units, water tanks, sewage tanks, etc. A grey water recycling unit can also be added to help reduce wastage of water. The water from the freshwater tank can be transferred to the toilet fittings via use of a small pressure pump.

The rear is completely utilized for battery and motor. There is free space provided all around the battery area and vents are given in the hull so that there is efficient ventilation provided to dissipate the heat generated by the battery and motor

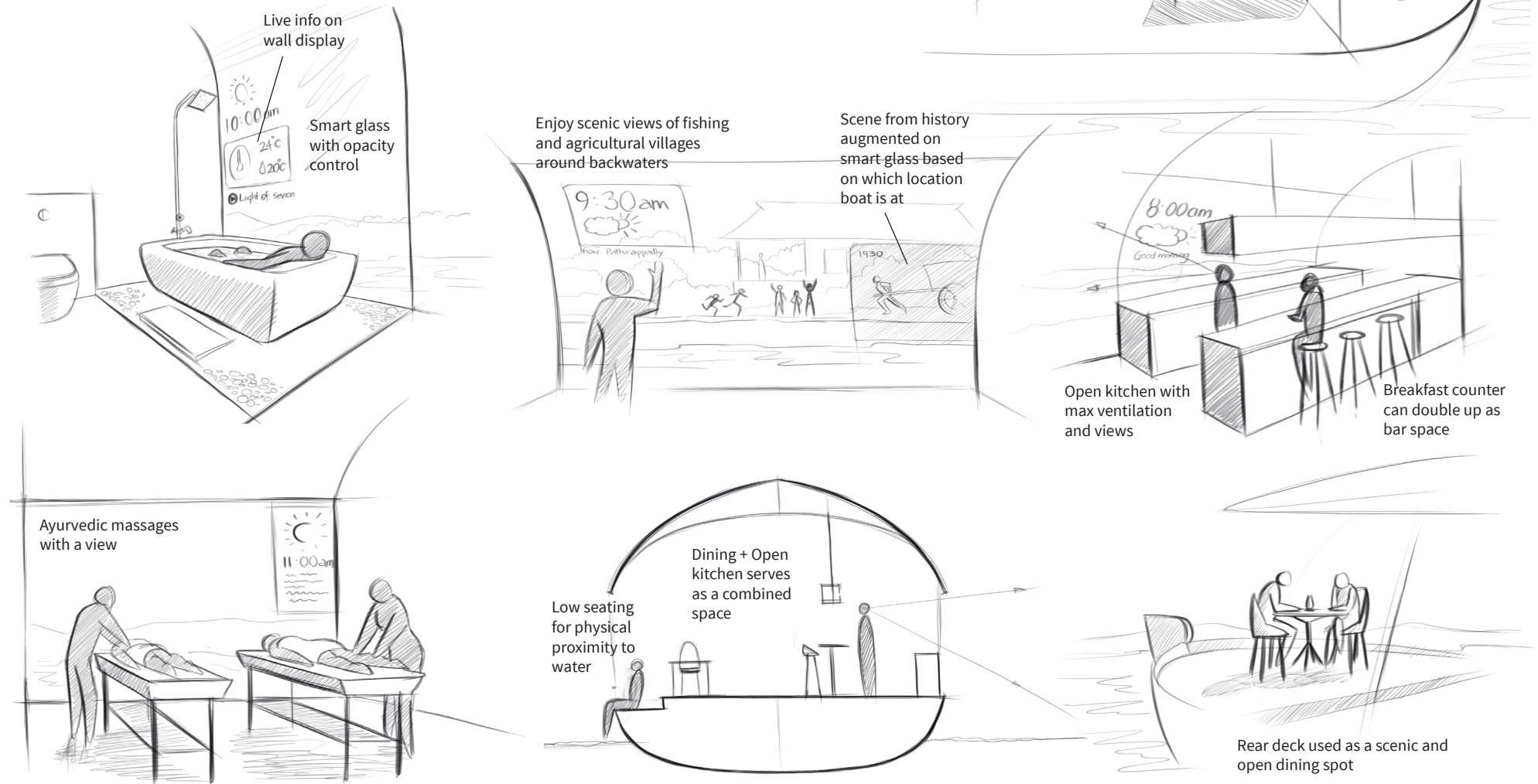


Img 63. Components which go into the hull to aid functioning of the house boat

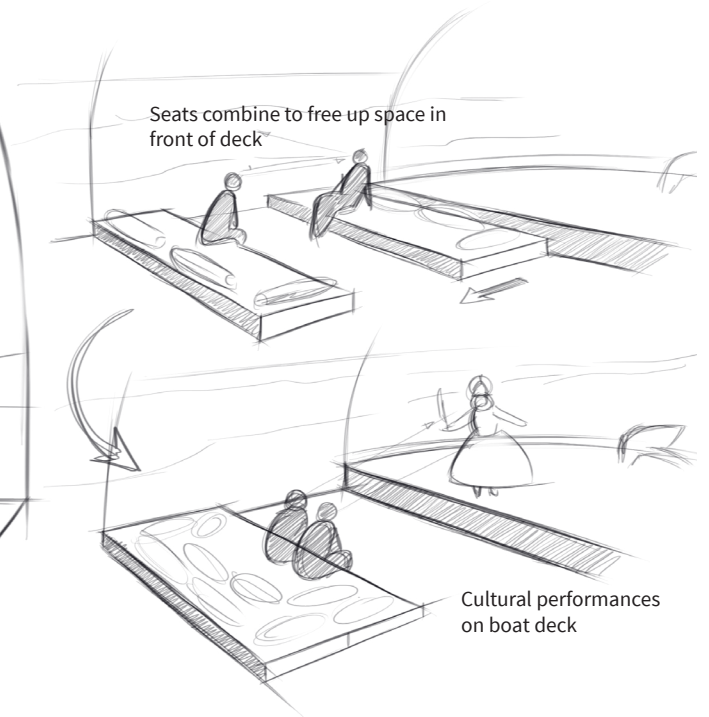
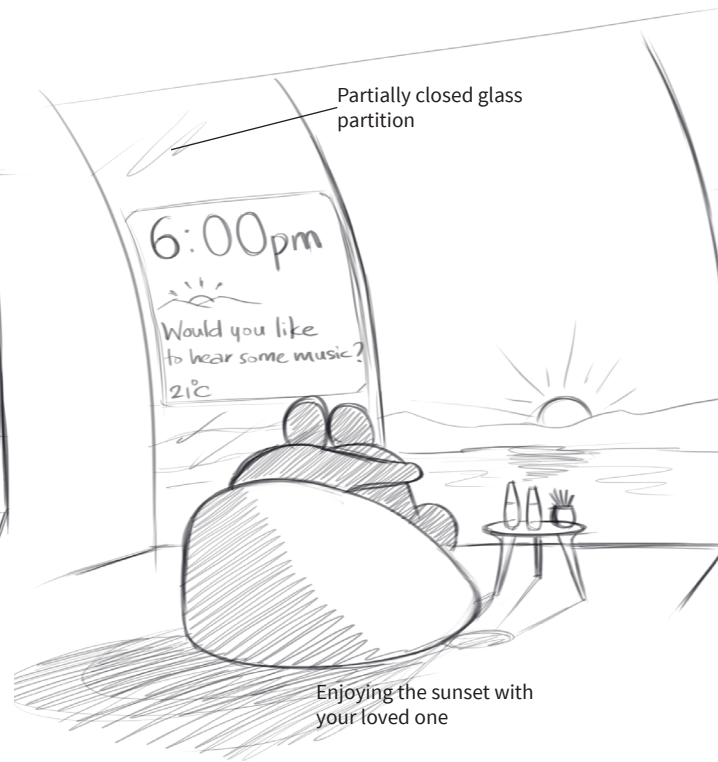
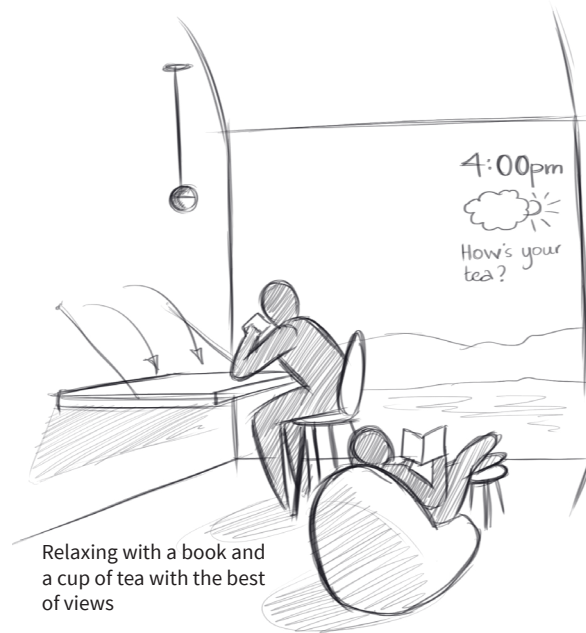
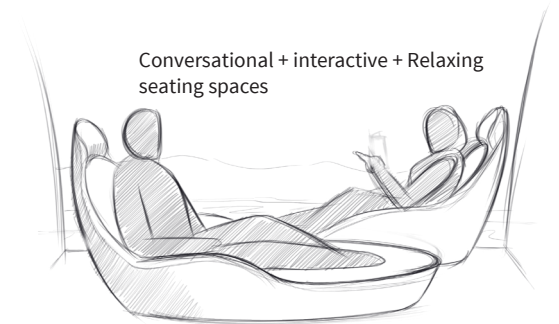
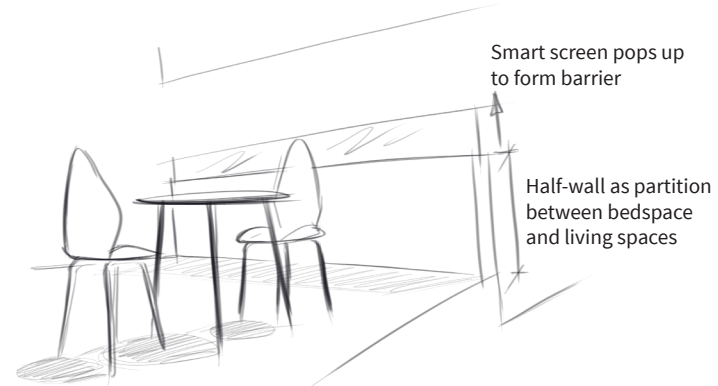
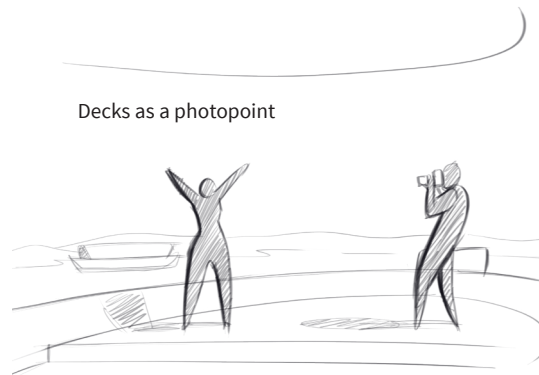
5. DESIGN

5.1 Experience Design

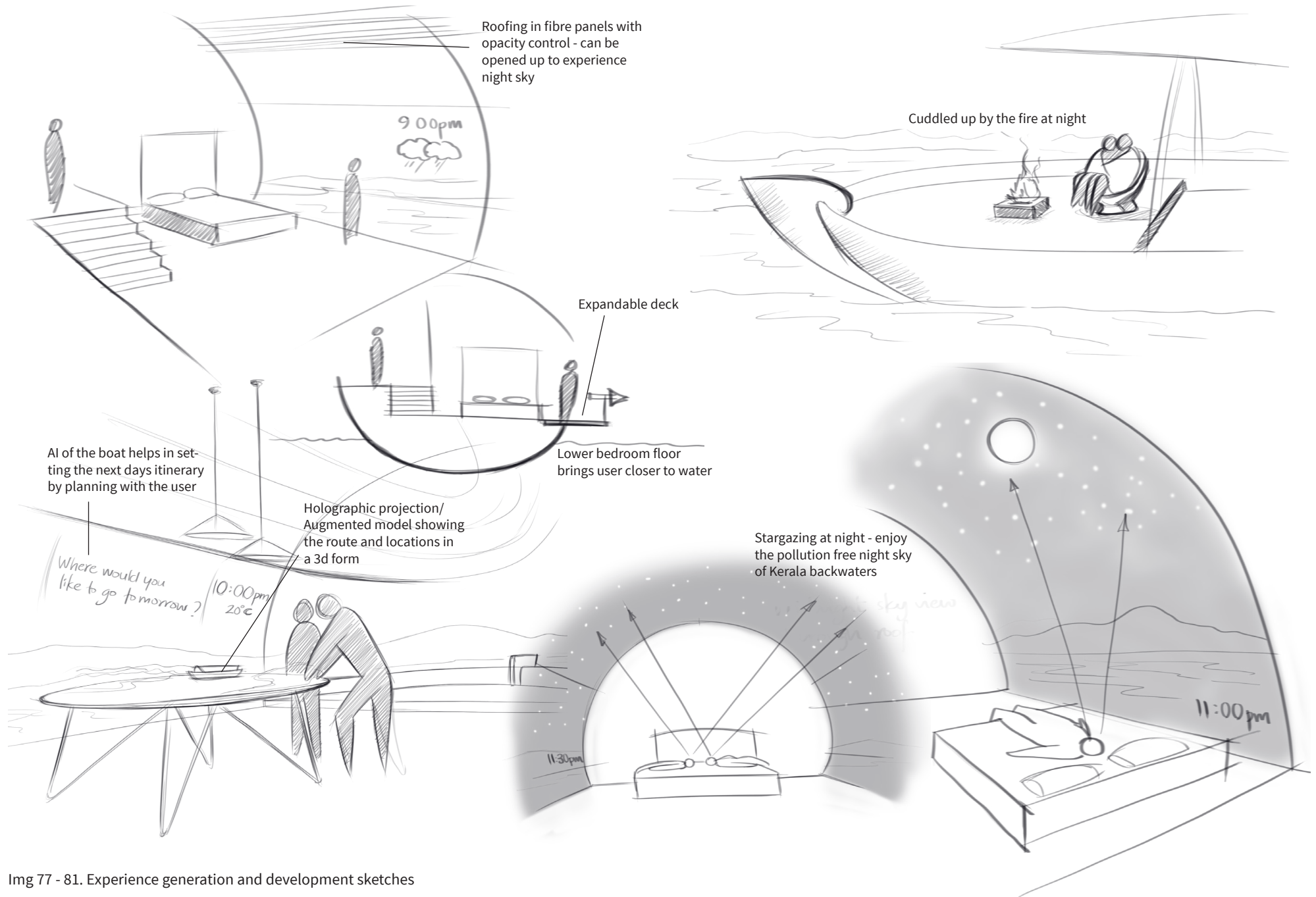
The participatory design exercise conducted with users serve as a base for developing new experiences. These experiences primarily revolve around the 2 key words which were drawn from the user research - scenery and relaxation.



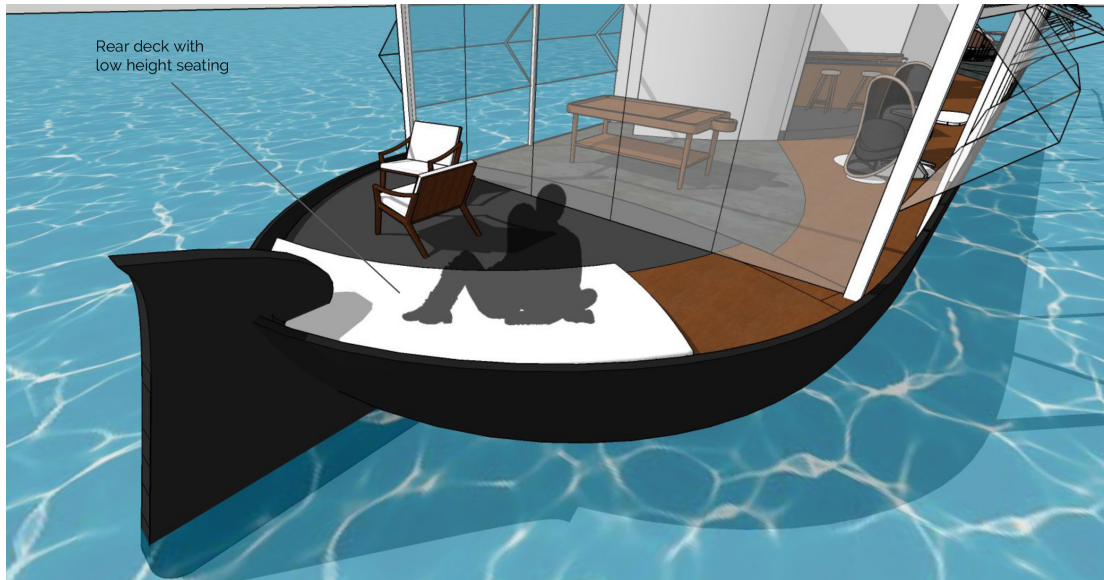
Img 64-70. Experience generation and development sketches



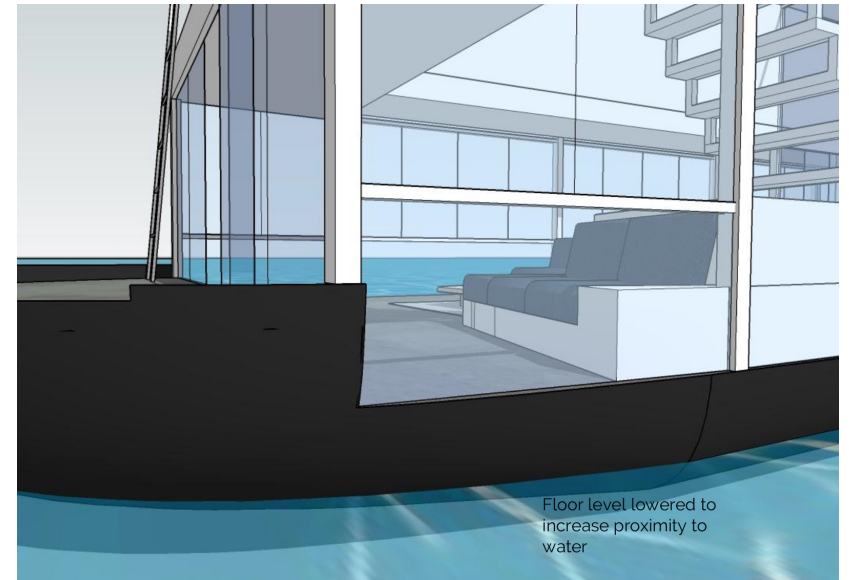
Img 71- 76. Experience generation and development sketches



Img 77 - 81. Experience generation and development sketches



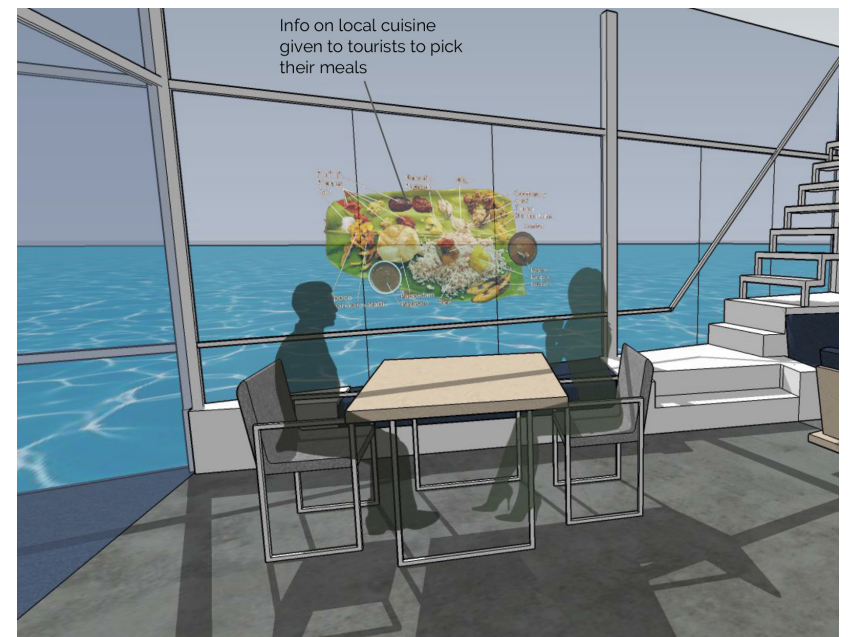
Img 82. Rear deck features low height seating spaces - can double as a low bed



Img 83. Floor level lowered to increase proximity to water - visually & physically

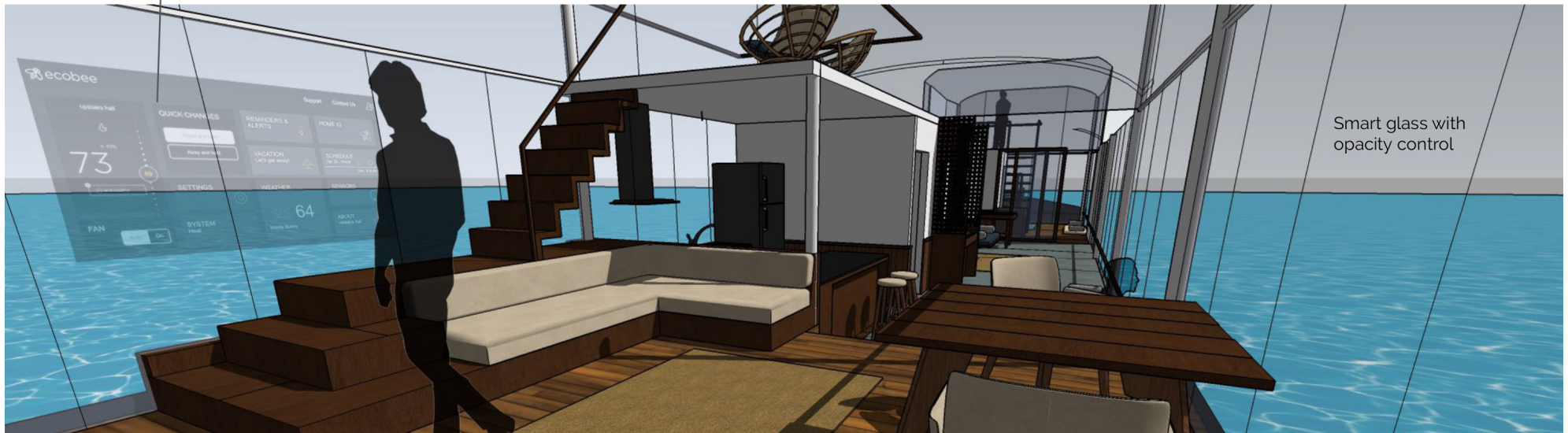


Img 84. Front deck doubles up as stage for cultural performances.



Img 85. Info of local cuisine given to tourists, who pick meals by telling the boat's AI

Smart screen showing weather data
as per user request



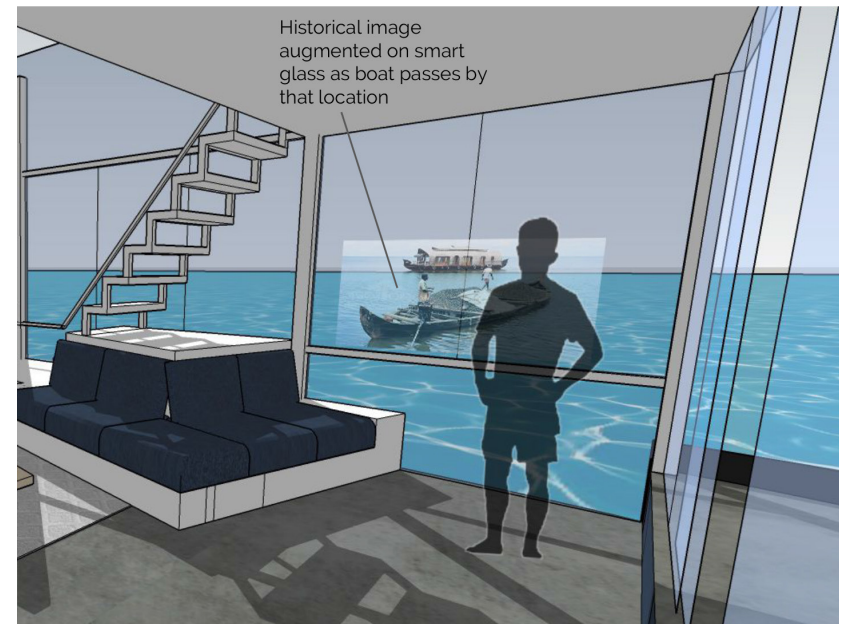
Img 86. Each space has a smart screen which shows live weather data, time, news, etc, so that user is informed. Additional widgets can be added as per user request. Boat AI responds to user request.

Smart screen showing live location
and route of boat's journey



Img 87. Glass with minimum frames offer an exquisite and open view of the entire area

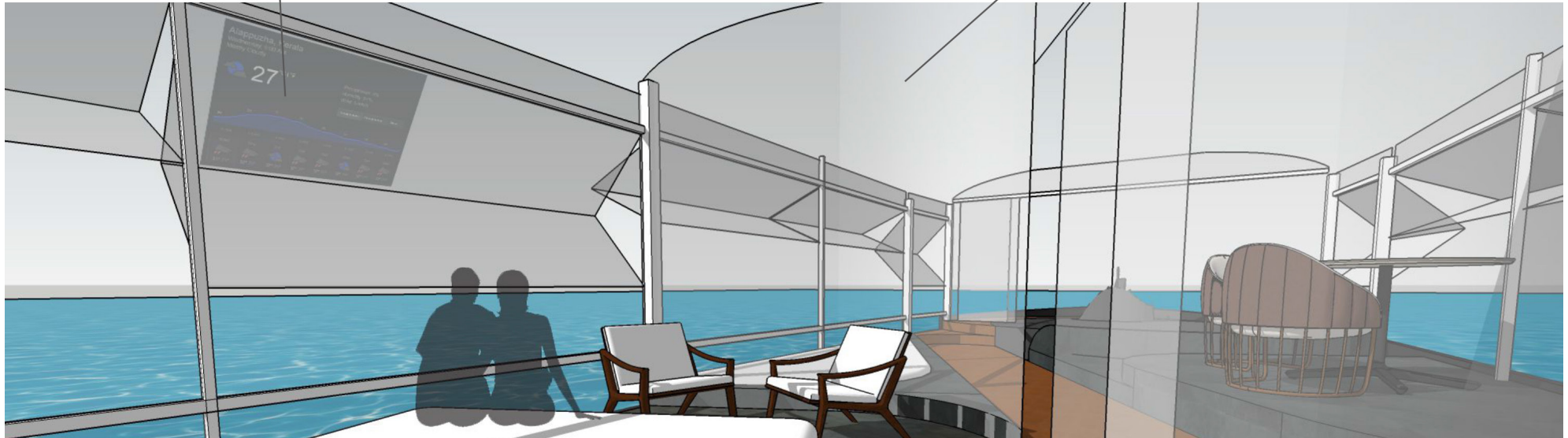
Historical image
augmented on smart
glass as boat passes by
that location



Img 88. Images augmented on screen as boat passes by area of historic importance

Weather, location details, etc
displayed glass where user
proximity is detected

Curved wall of the bedroom
with smart glass



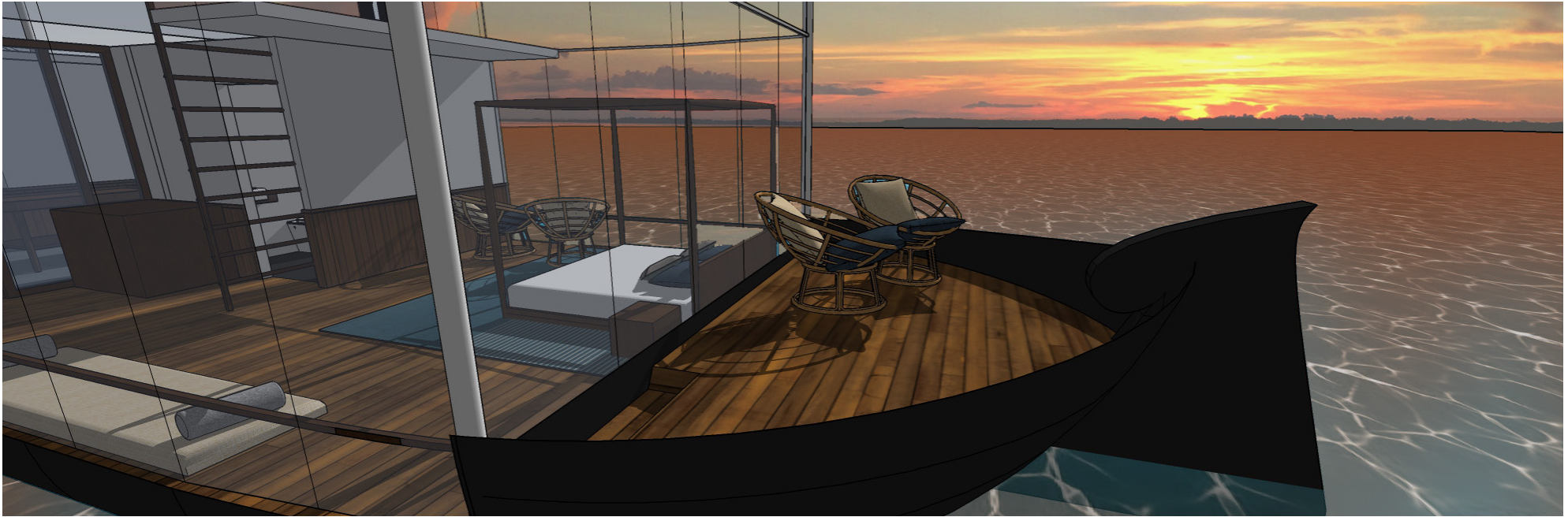
Img 89. Bedroom also offers seamless views of the backwaters. Opacity control glass walls ensure privacy when required

Weather, location details, etc
displayed glass where user
proximity is detected

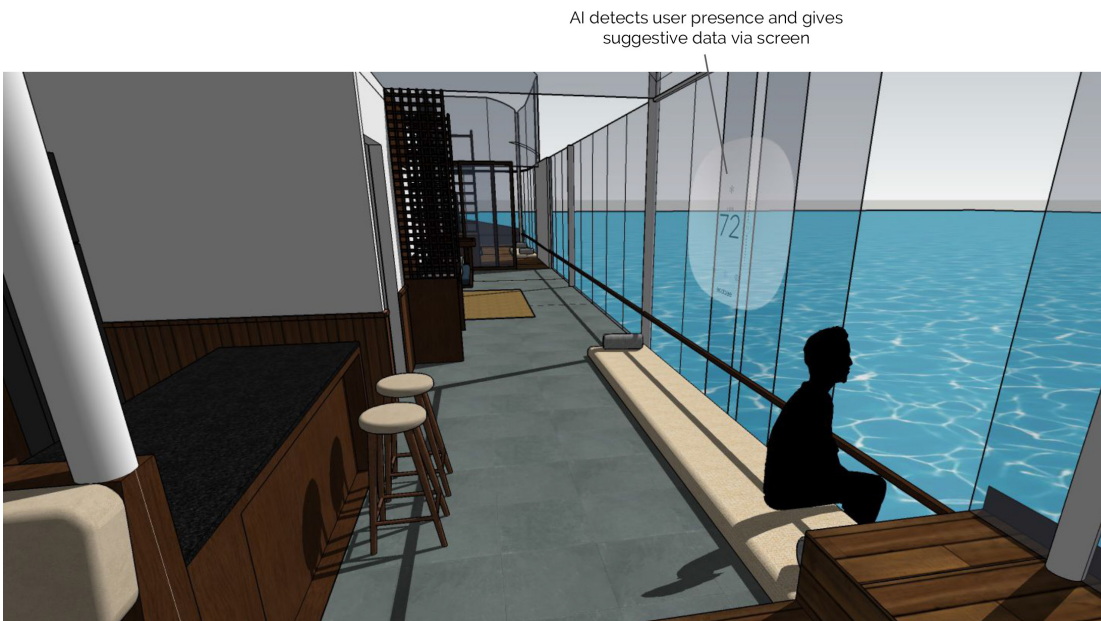
Enjoy night skies from bedroom
itself



Img 90. The open planning ensures that the clear starry sky is seen even while lying on the bed

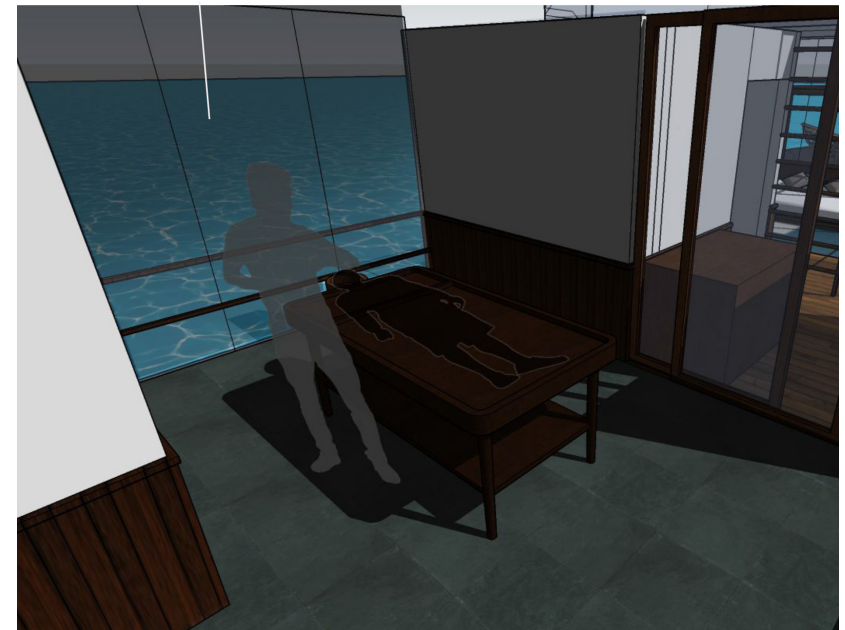


Img 91. Serene and scenic sunsets can be enjoyed from the completely private rear deck



AI detects user presence and gives suggestive data via screen

Img 92. Low seating gives the user a chance to wet his feet while enjoying the backwater cruise



Img 93. Ayurvedic massage relaxes the purifies the entire body of the user

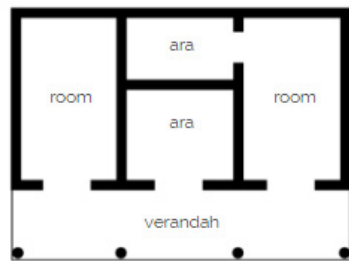
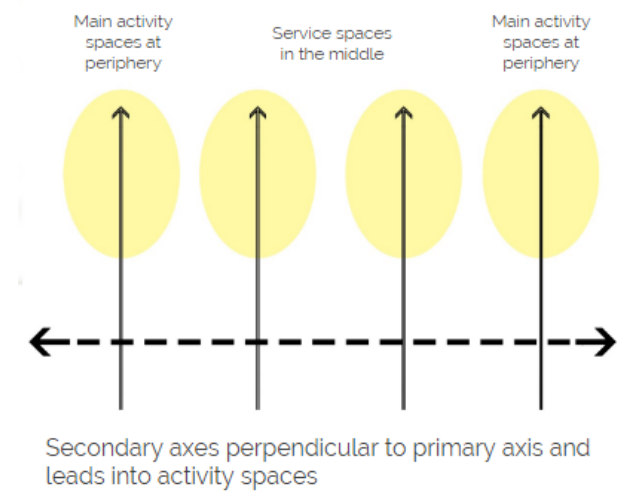
5.2 Layout Design

5.2.a CONCEPT 1

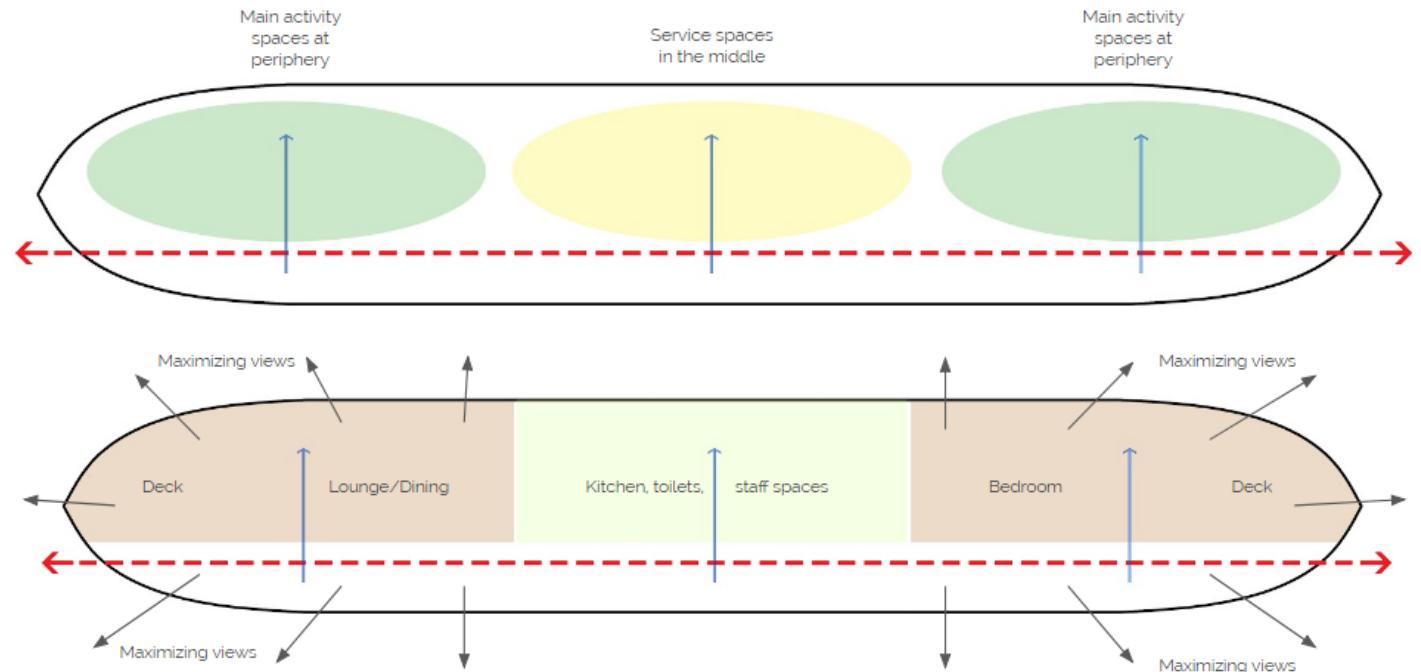
'Ekasala' is the basic unit of Kerala traditional architecture - which then multiplies to randukettu, naalukettu, ettukettu etc. This basic unit has a very peculiar planning. There is a circulation passage on one side and residential spaces on the other. The main activity rooms are towards the periphery and they flank the services and storage space which are in the middle.

The basic idea of this ekasala can be utilized to develop a layout for the houseboat. The major axis on one side would serve as an eccentric spine which serves all the flanking spaces.

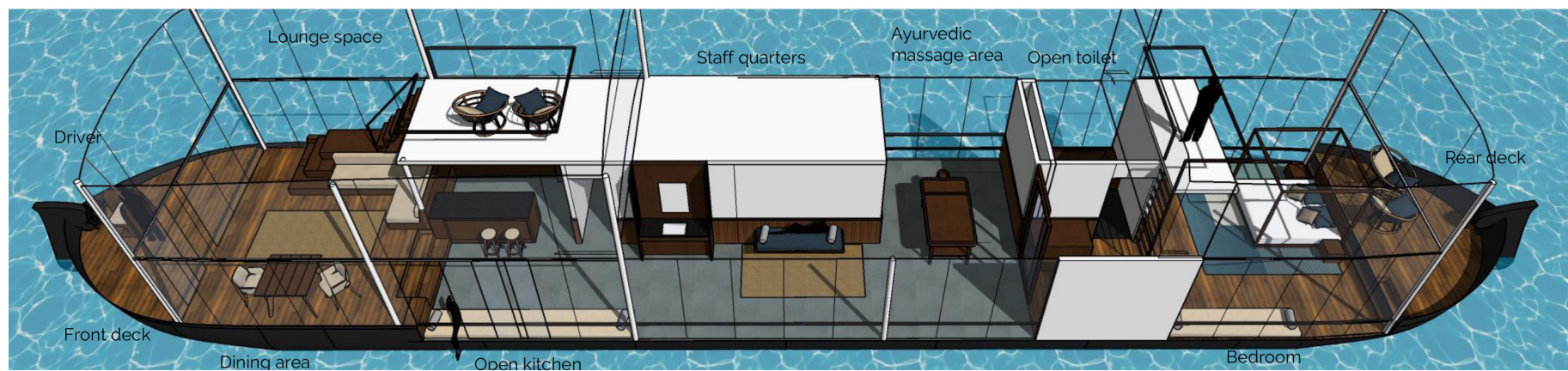
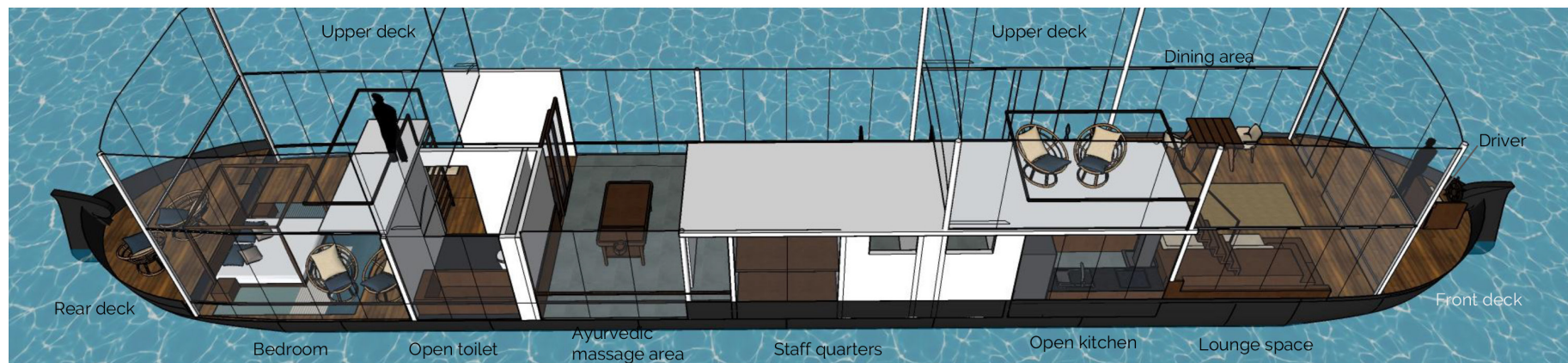
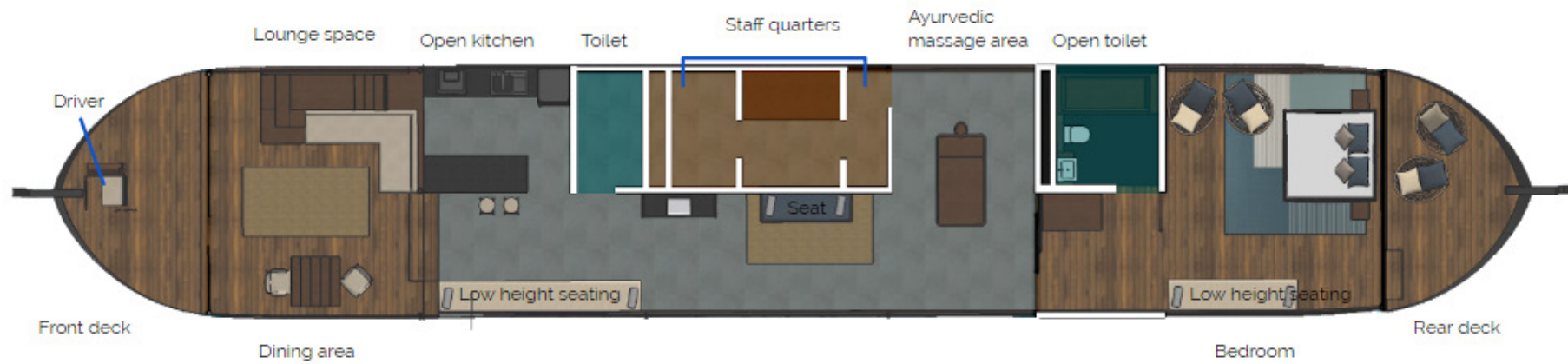
This layout has the bedspace at the rear to allow maximum space for activities of the user and also allows for unrestricted views all around.



Traditional Kerala Ekasala House



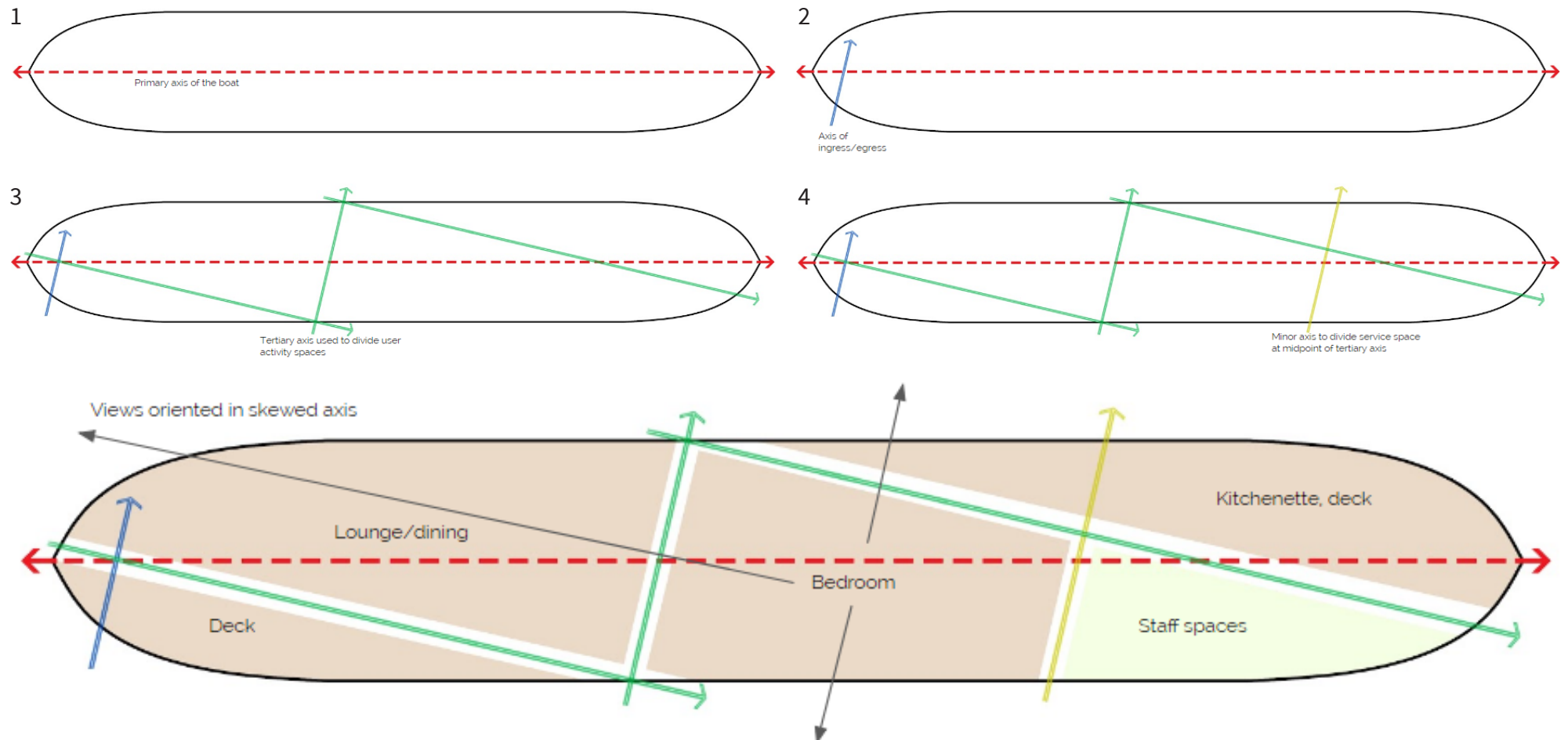
Img 94. Concept 1 : Development of zoning and schematic layout



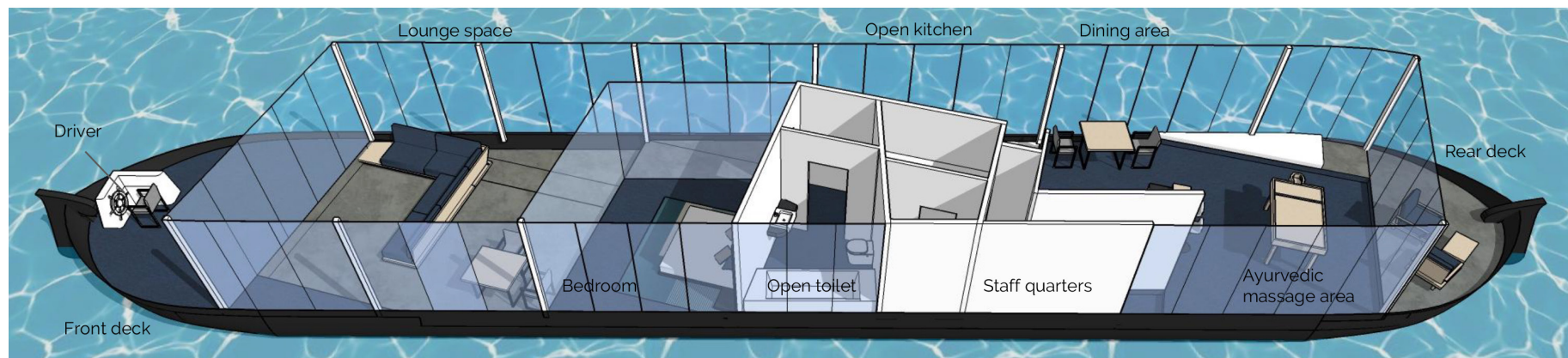
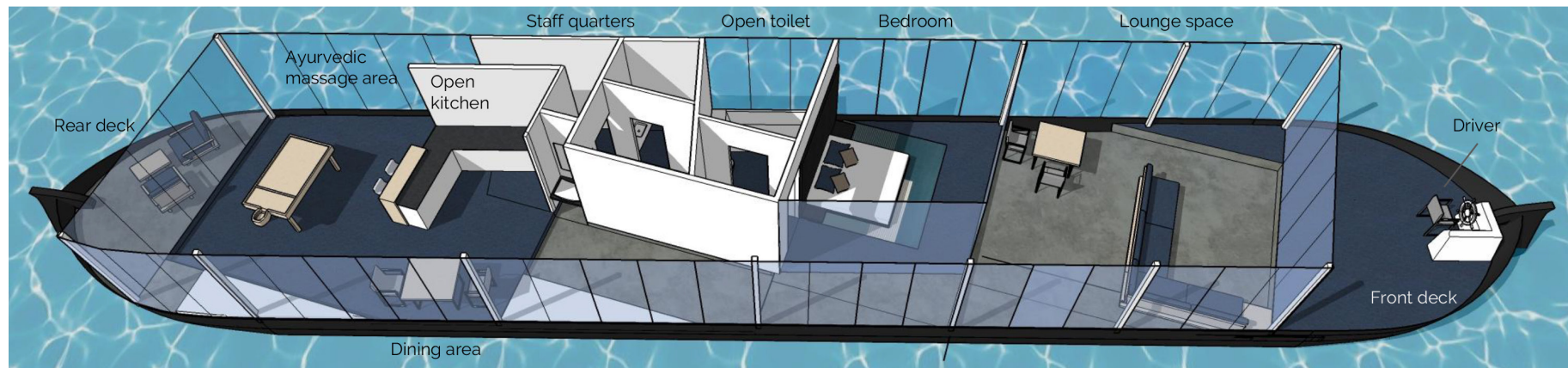
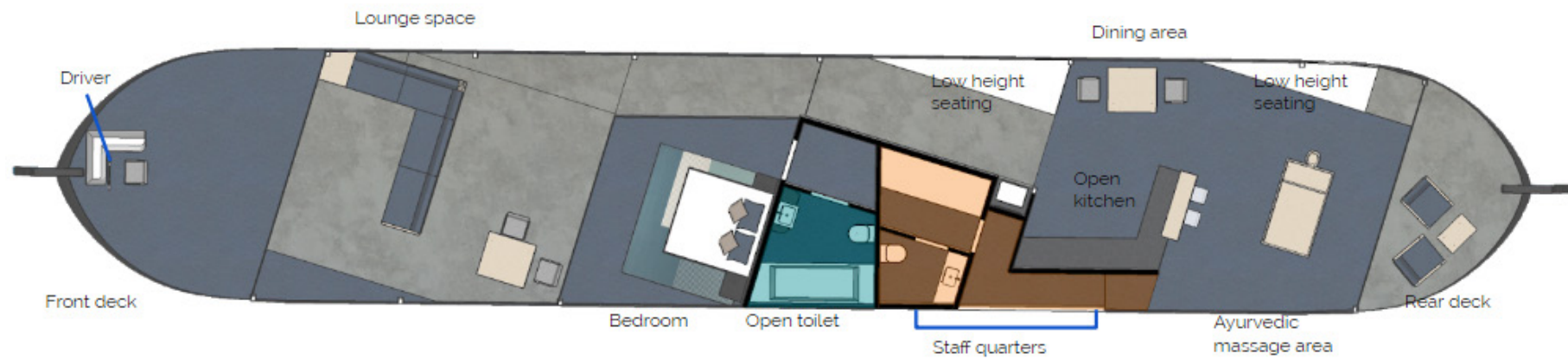
Img 95. Concept 1: Layout

5.2.b CONCEPT 2

This skewed layout concept takes advantage of shifting the orientation of the spaces in such a way that maximum view is obtained from each space. The major axis is sliced by tertiary axes to create activity spaces for the user. This develops angular spaces which look out without other spaces hindering the view. Multiple levels also come into play to enhance the overall spatial experience. Low seating spaces have been provided in multiple places for the user to enjoy close proximity with water.



Img 96. Concept 2 : Development of zoning and schematic layout



Img 97. Concept 2: Layout

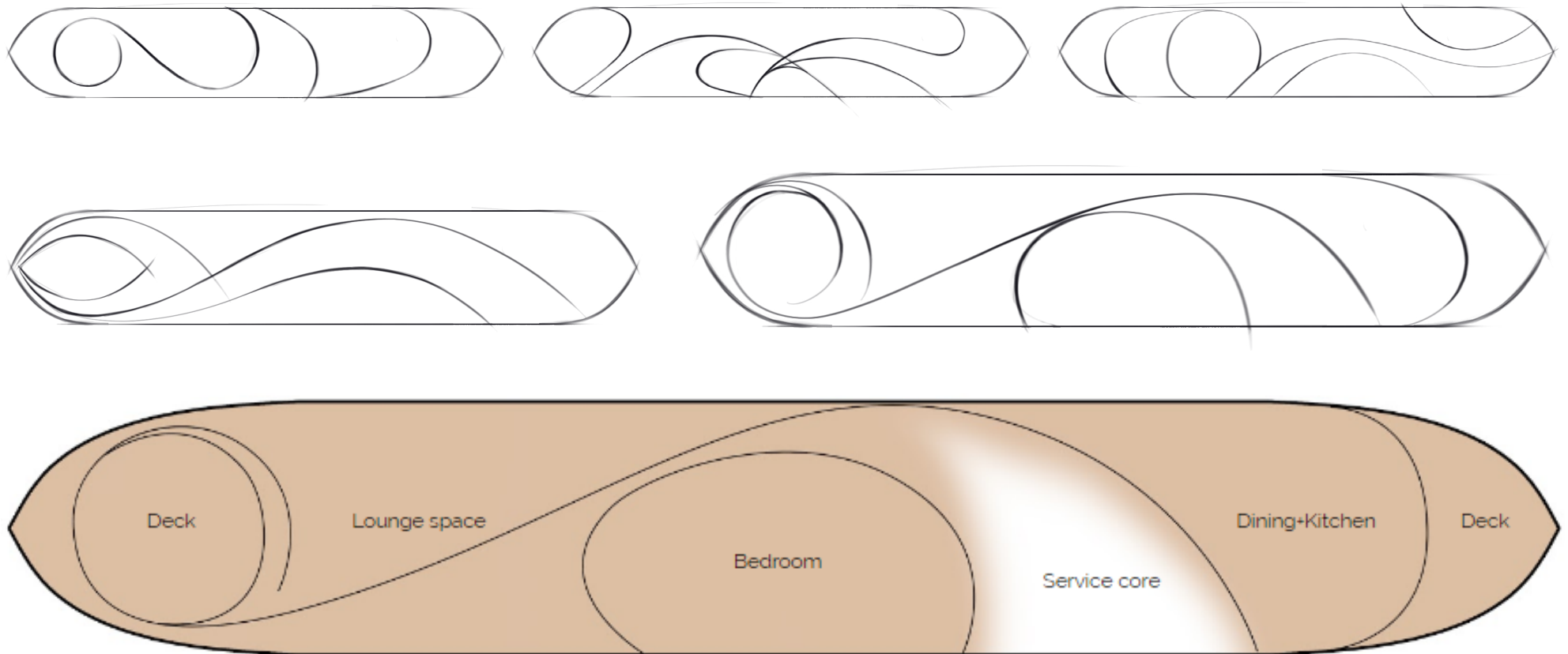
5.2.c CONCEPT 3

Inspired by traditional 'Kadhakali' masks, this concept provides interesting spaces which has been developed in an organic manner. 'Kadhakali' is one of the most prominent traditional dance forms of Kerala. The costume, inclusive of the mask presents a very colourful and powerful image by which mythological hindu characters are represented. The pigments used for colouring the face and mask are completely natural and hence give a very grounded feel to the overall art form.

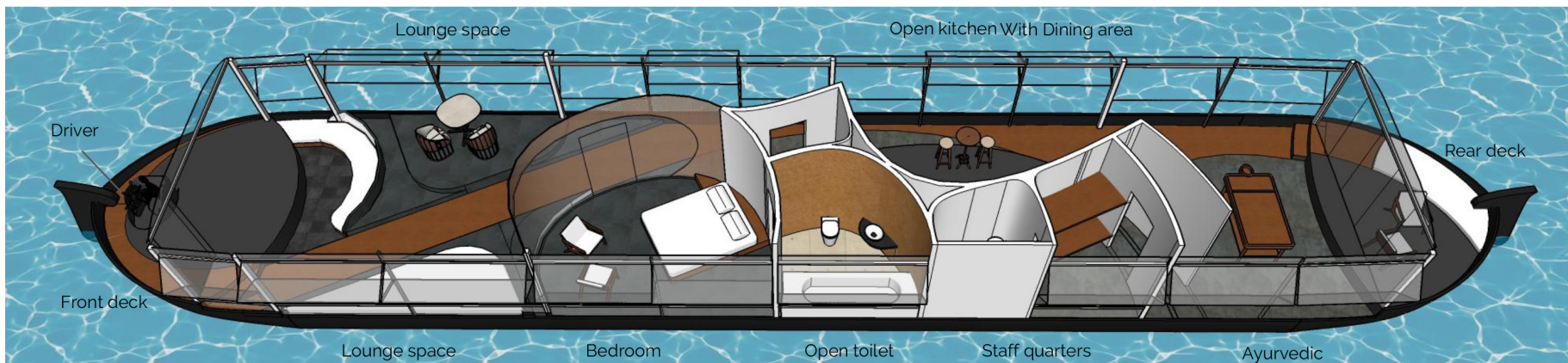
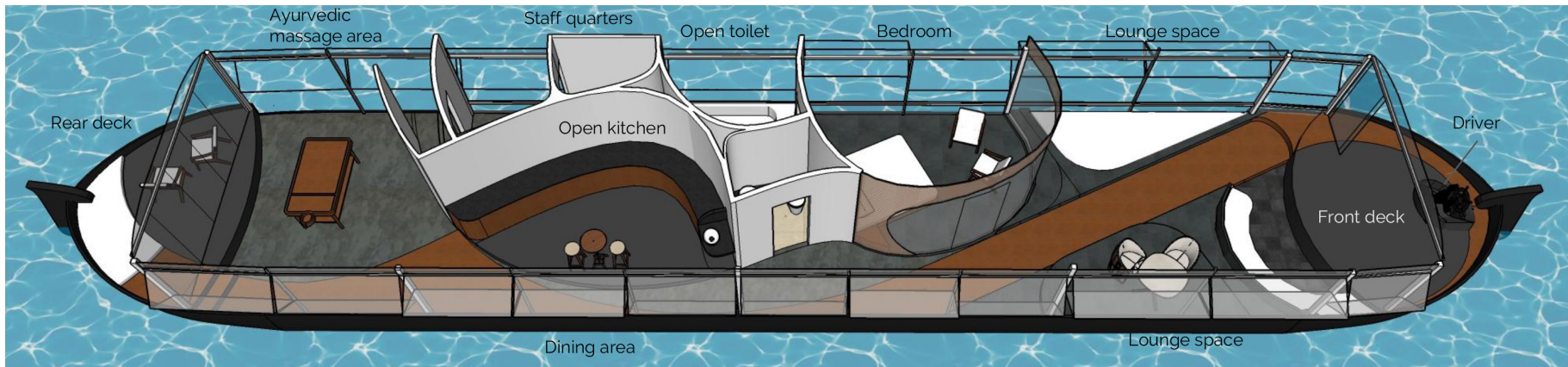
The mask of the kadhakali has very interesting patterns which are used as the inspiration to develop spaces.



Img 98-100. Kadhakali - traditional dance form of Kerala



Img 101. Concept 3 : Development of zoning and schematic layout



Img 102. Concept 3: Layout

5.2.d USER EVALUATION

A user evaluation was conducted to determine the best layout among the three based based on certain criteria. The users selected were regular travellers and tourists who are well versed with the backwater tourism scenario and condition of present houseboats. The evaluation of the layouts were done on the basis of :

- Which one do you think reflects the idea & essence of Kerala, but gives you a new and modern experience?
- How relaxing the user finds these spaces (rate 1-5)
- Which one does the user think gives them maximum views
- Which one would the user pick if he were to go for a 1 day cruise.

Of the 27 responses (14 males, 13 females) collected, the results are as follows:

Criteria	Concept 1	Concept 2	Concept 3
Which one do you think reflects the idea & essence of Kerala, but gives you a new and modern experience?	6 users	5 users	16 users
How relaxing the user finds these spaces (rate 1-5)	Avg - 3.4	Avg - 3.6	Avg - 3.7
Which one does the user think gives them maximum views	6 users	9 users	12 users
Which one would the user pick if the user were to go for a 1 day cruise.	8 users	7 users	12 users

Table 1. User evaluation of Layouts

From the evaluation, it is evident that concept 3 is perceived as the most open, interesting, view friendly option. Therefore it is developed further, refined and detailed out to obtain a final designed interior.

5.3 Form Design

5.3.a MOOD BOARD

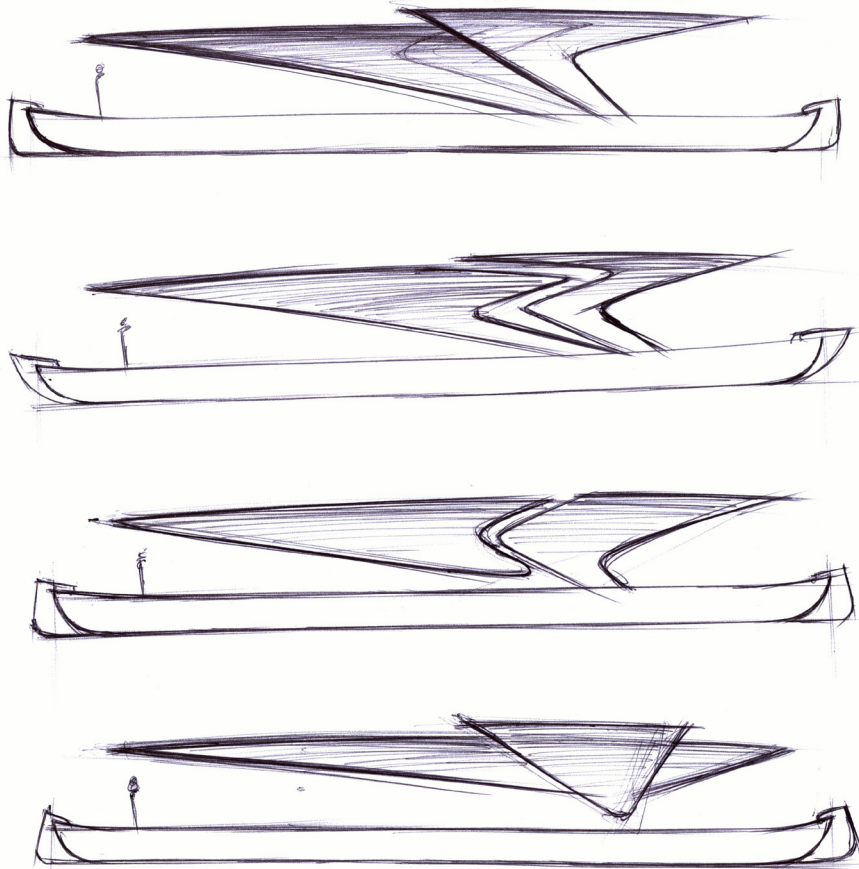
While conducting the participatory design activity, the first images which came to the mind of users when they were asked about Kerala was of different festivals, cultures and how they all coexist in a synergistic relationship.



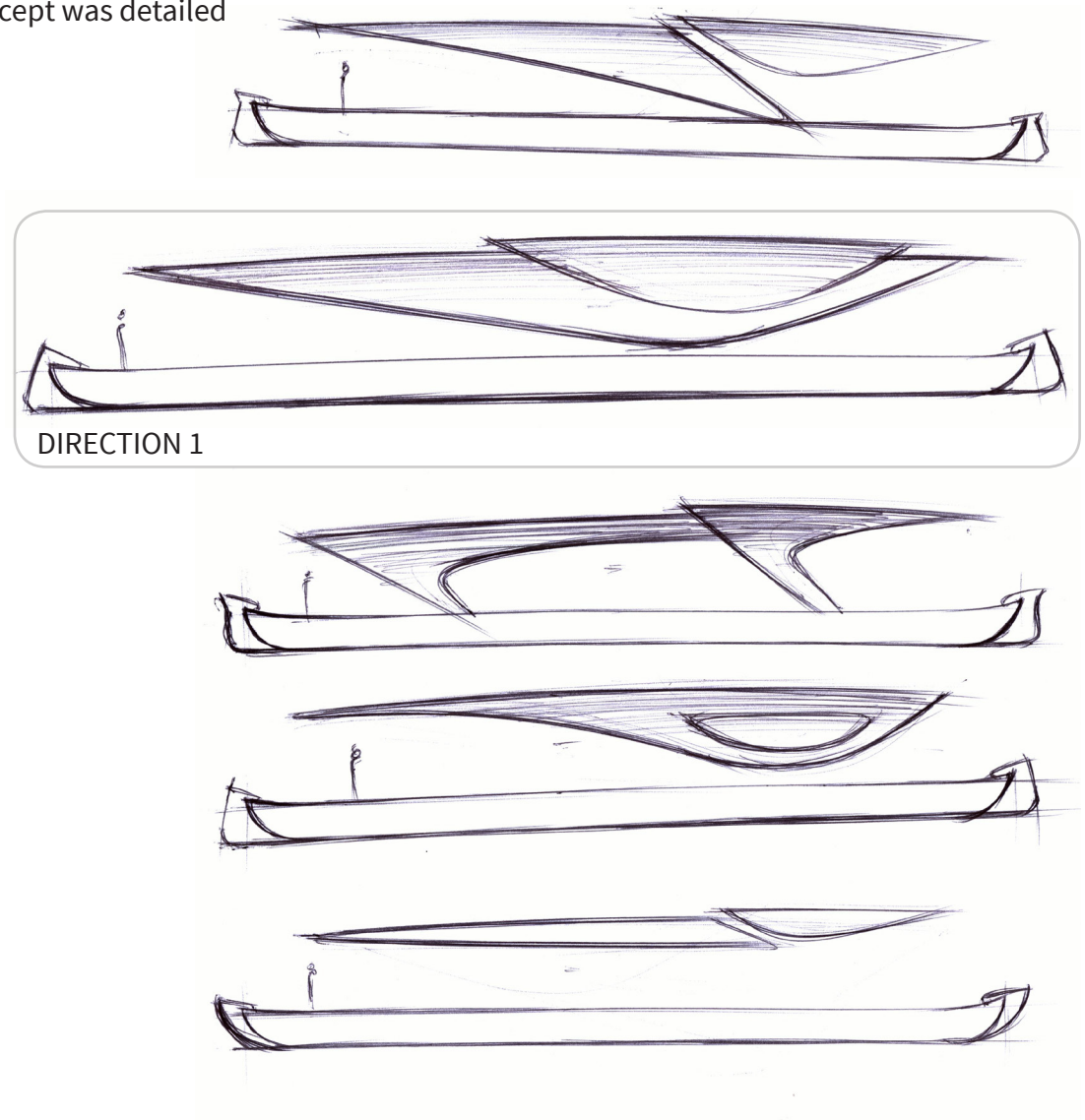
Img 103. Mood board

5.3.b IDEATION SKETCHES

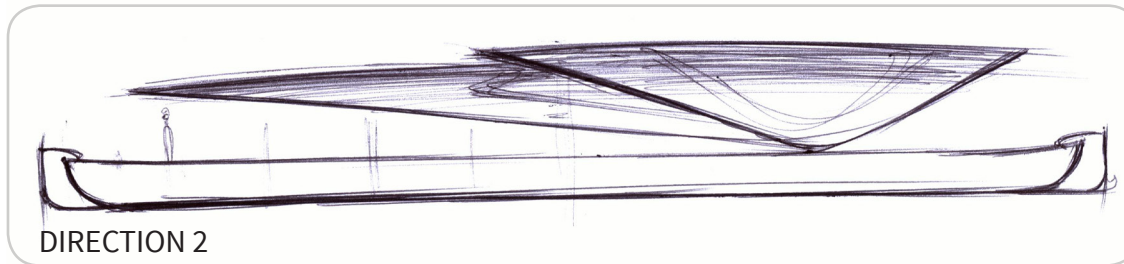
Sketches based on the mood board were made from which 4 sketch directions which best expressed the moods were picked out. These directions were further explored and developed till a final concept was drawn from it. This final concept was detailed out to form the final design



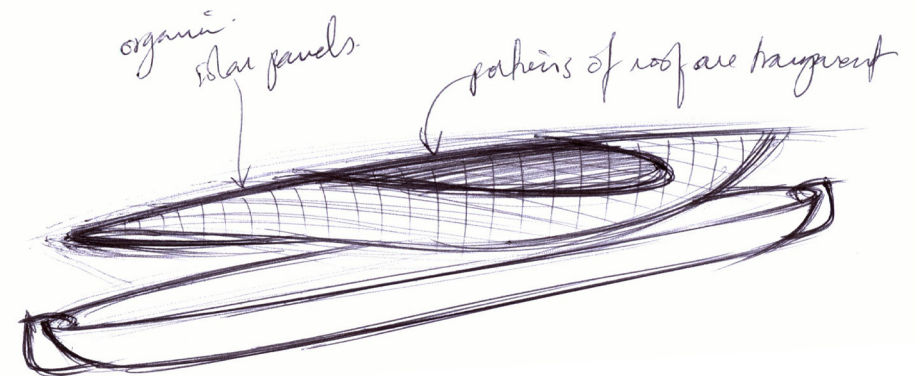
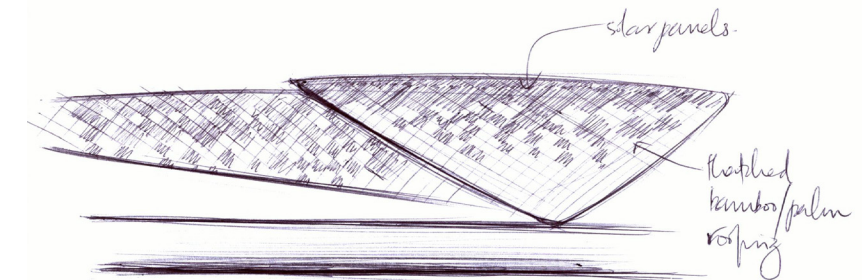
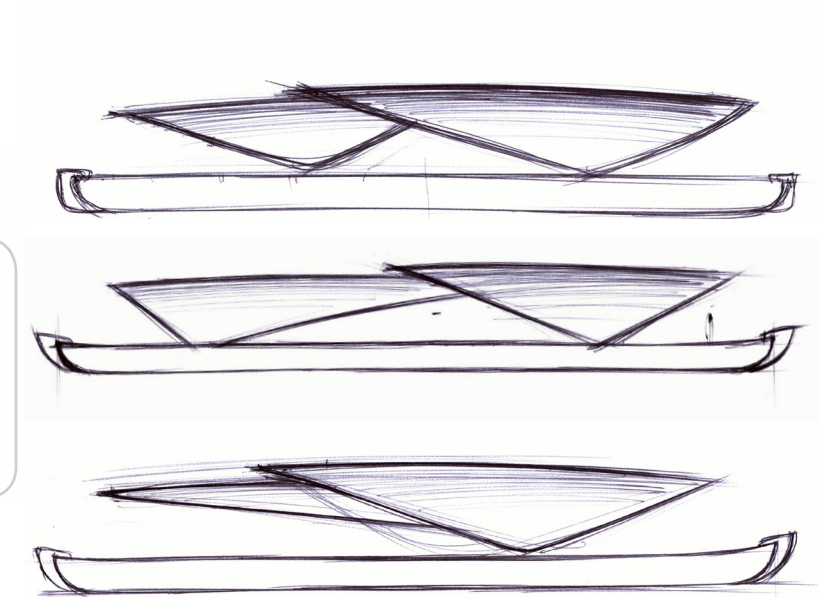
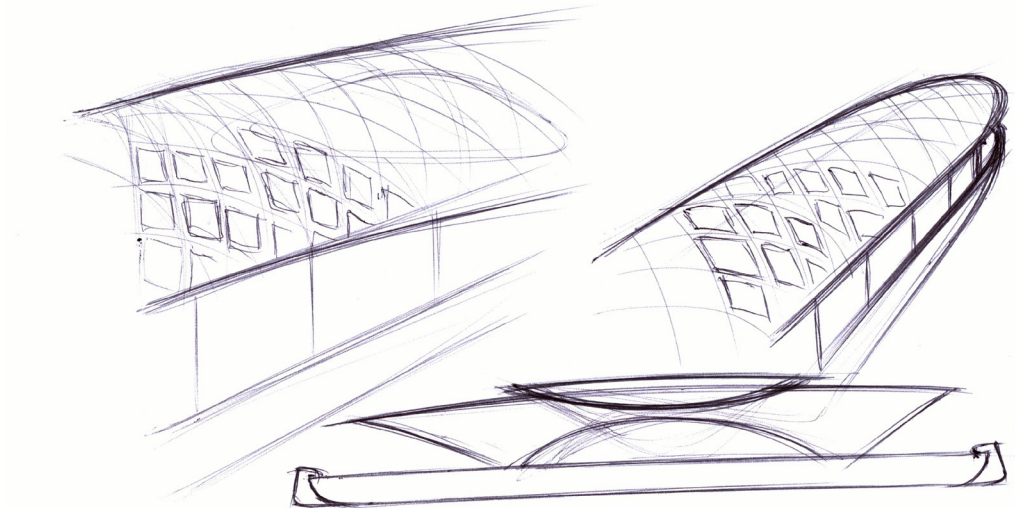
Ideation based on sweeping sharp forms which are inspired by the 'Chundan vallam'. The split roof structures are an attempt at developing new forms by modifying the existing 'valavara' feature of houseboats

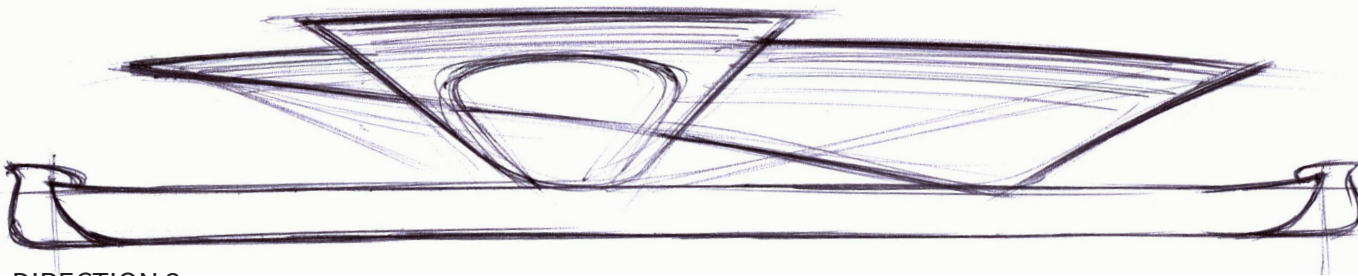
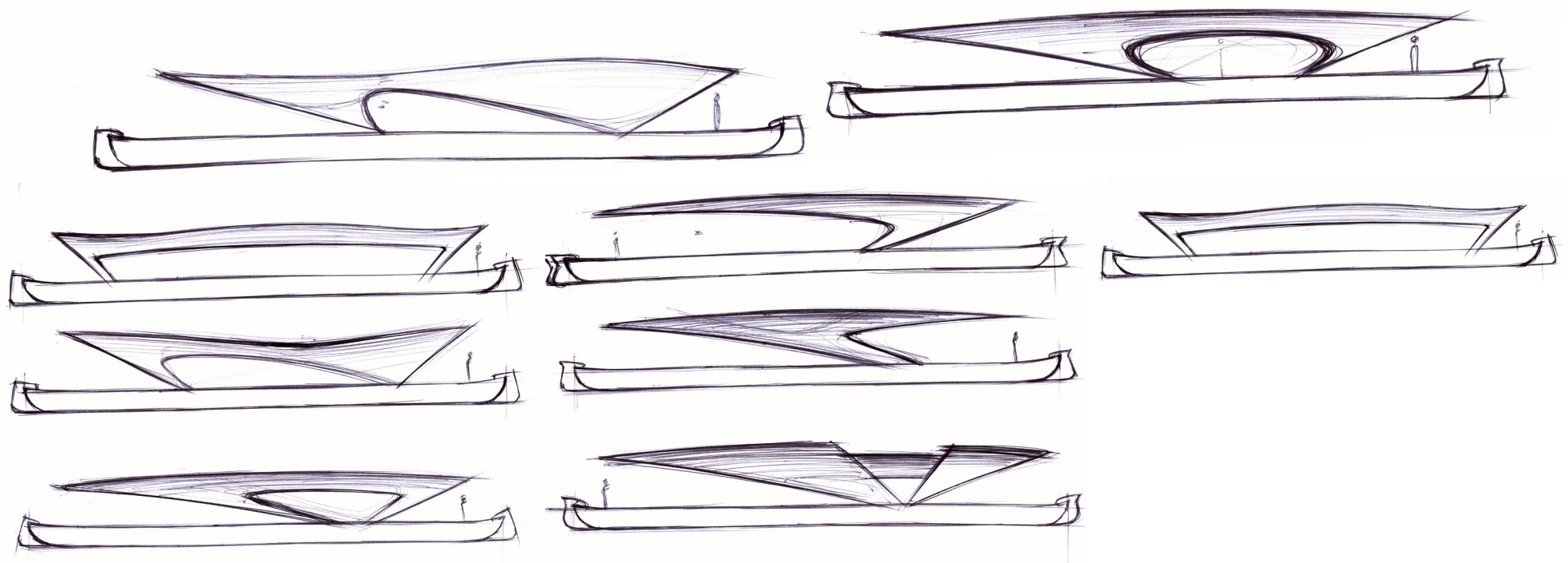


Ideas based on an expansive roof over a smaller and sleeker secondary canopy was worked out to achieve a simpler yet bold volume for the entire canopy.



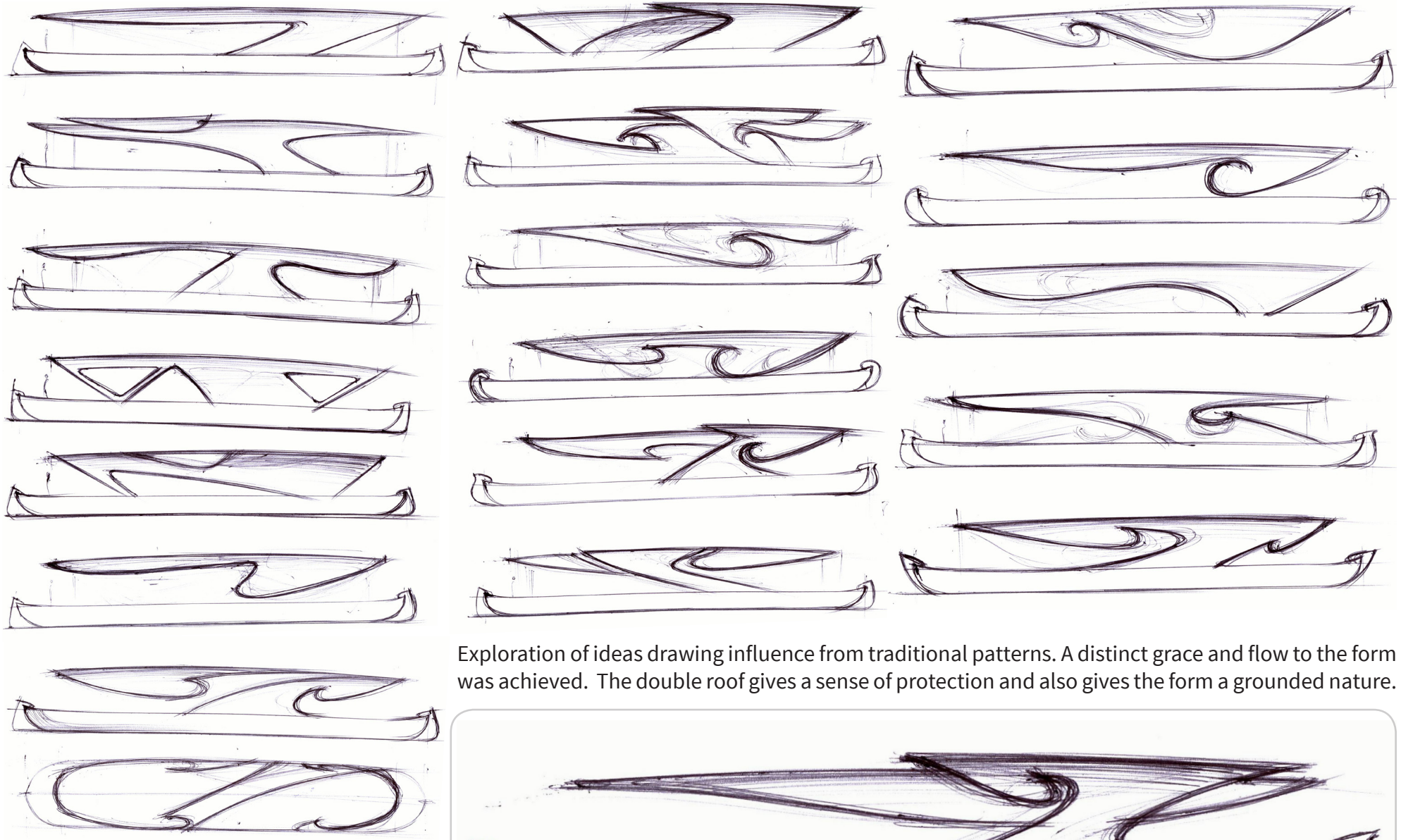
The canopy would have solar panels embedded on it in a pattern which accentuates the overall form of the boat.



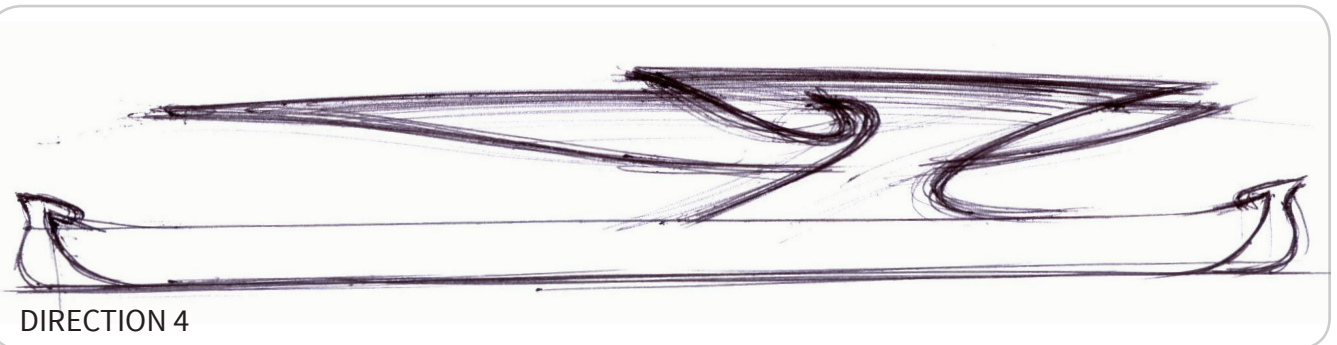


DIRECTION 3

Ideas with variations of the canopy was worked out keeping in mind spaces which would require views and which don't.



Exploration of ideas drawing influence from traditional patterns. A distinct grace and flow to the form was achieved. The double roof gives a sense of protection and also gives the form a grounded nature.

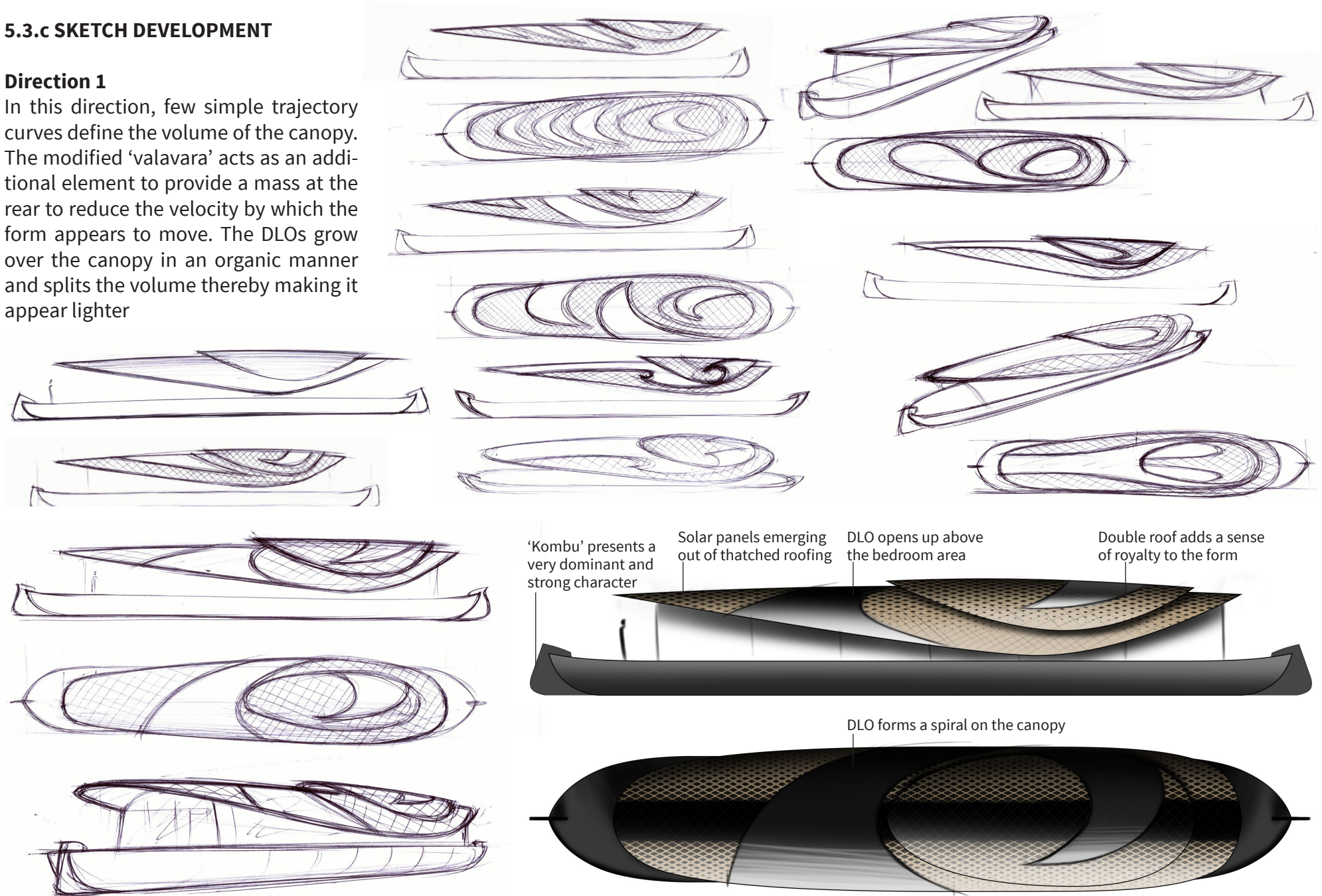


DIRECTION 4

5.3.c SKETCH DEVELOPMENT

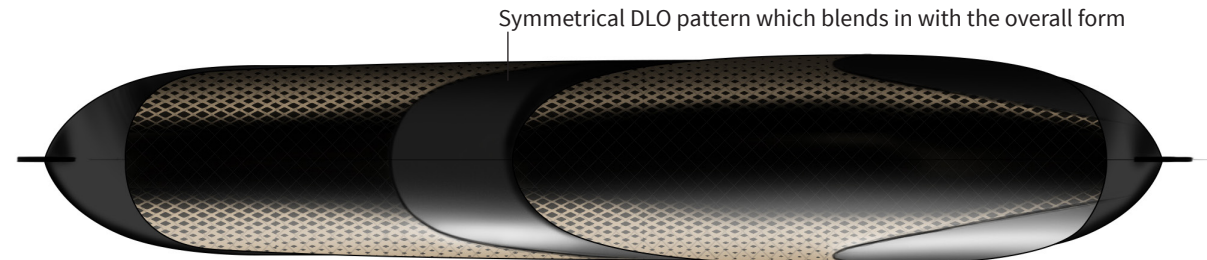
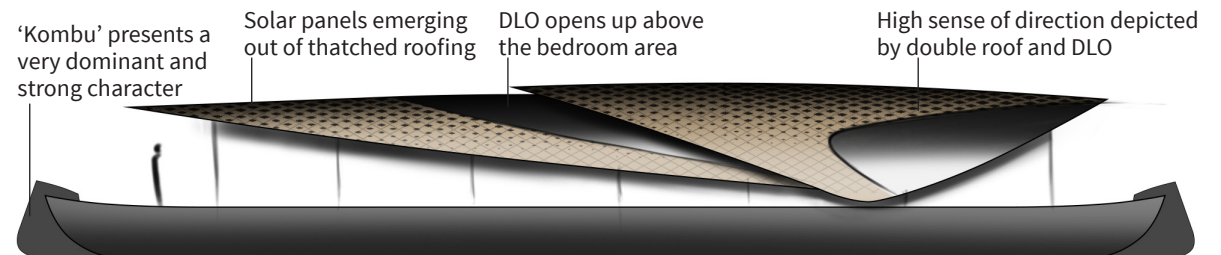
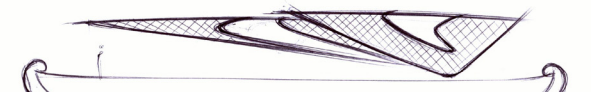
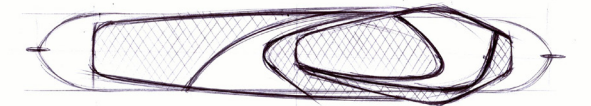
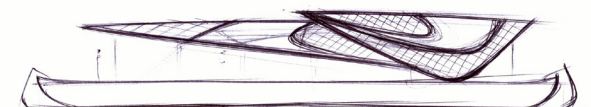
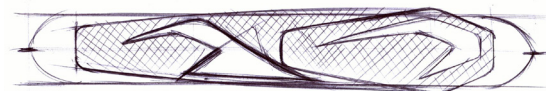
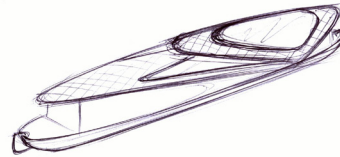
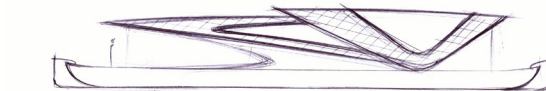
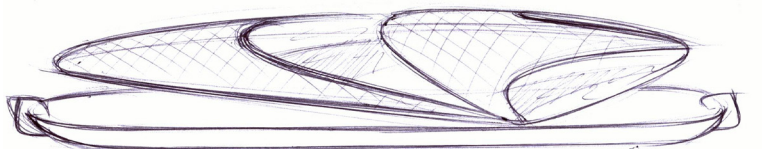
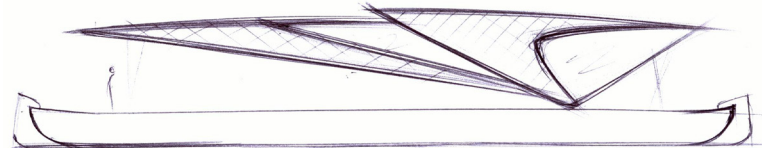
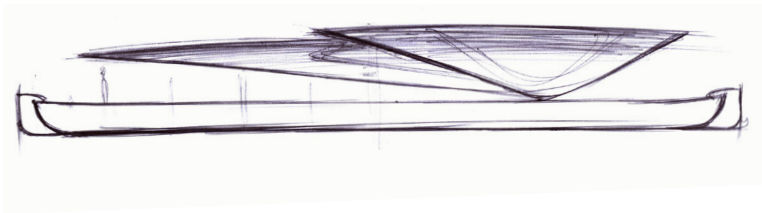
Direction 1

In this direction, few simple trajectory curves define the volume of the canopy. The modified 'valavara' acts as an additional element to provide a mass at the rear to reduce the velocity by which the form appears to move. The DLOs grow over the canopy in an organic manner and splits the volume thereby making it appear lighter



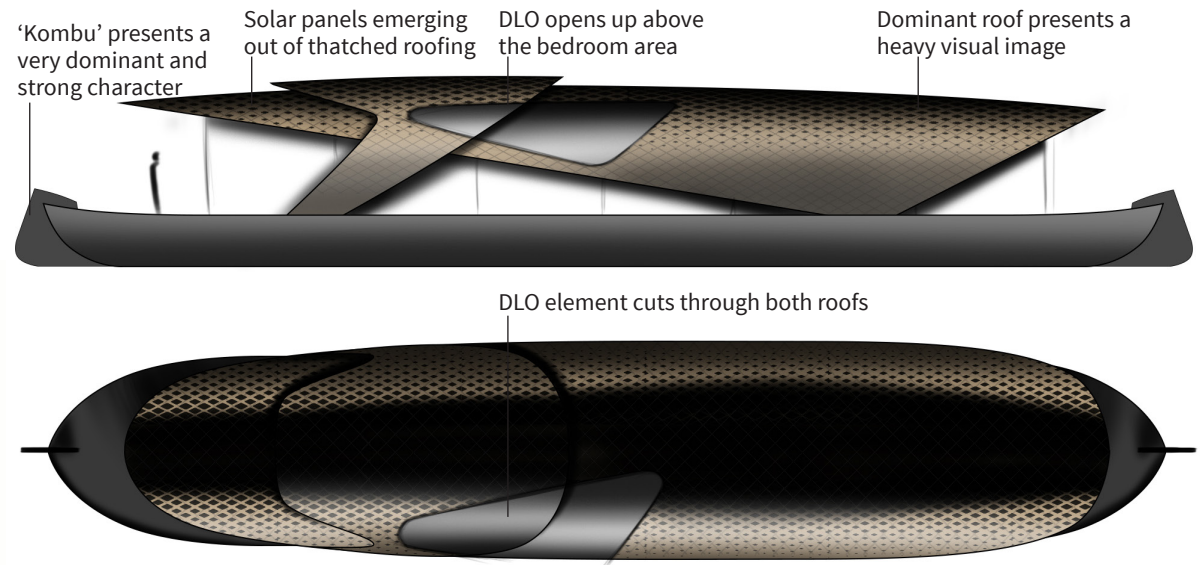
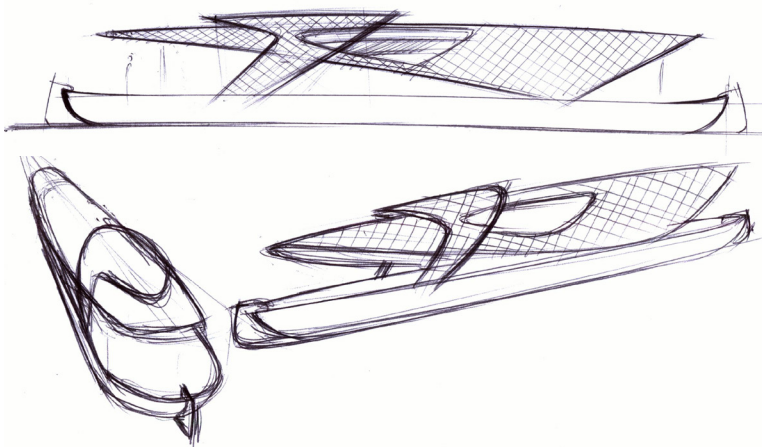
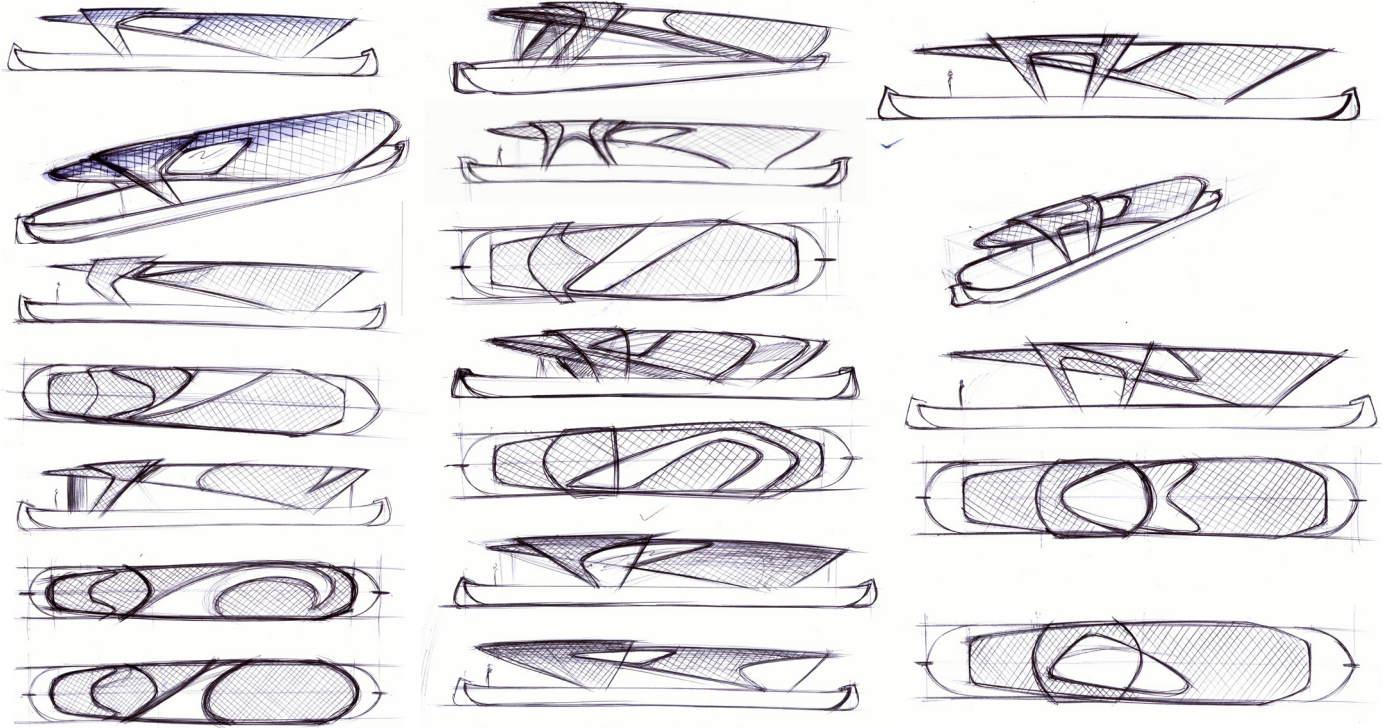
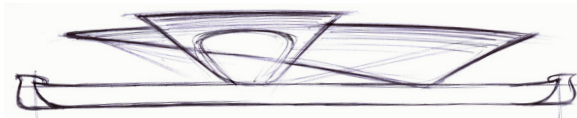
Direction 2

This direction deals with strong directional and accented curves that give a strong sense of direction to the form. The upper canopy plays the dominant role and the lower one serves as a sub-dominant which emerges out of the former. The DLO patterns aid in directionality of the form.



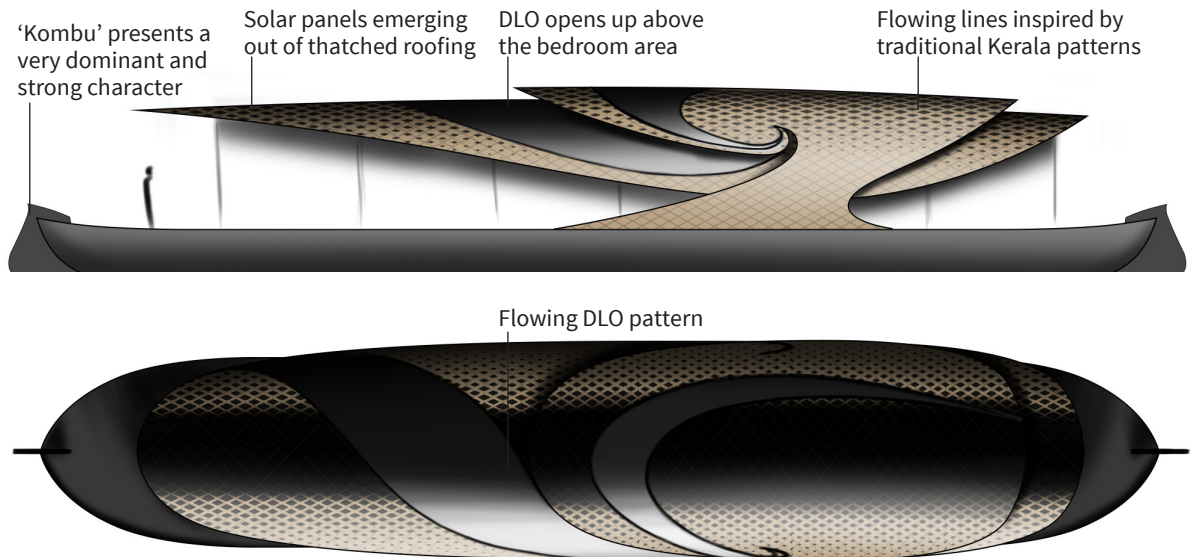
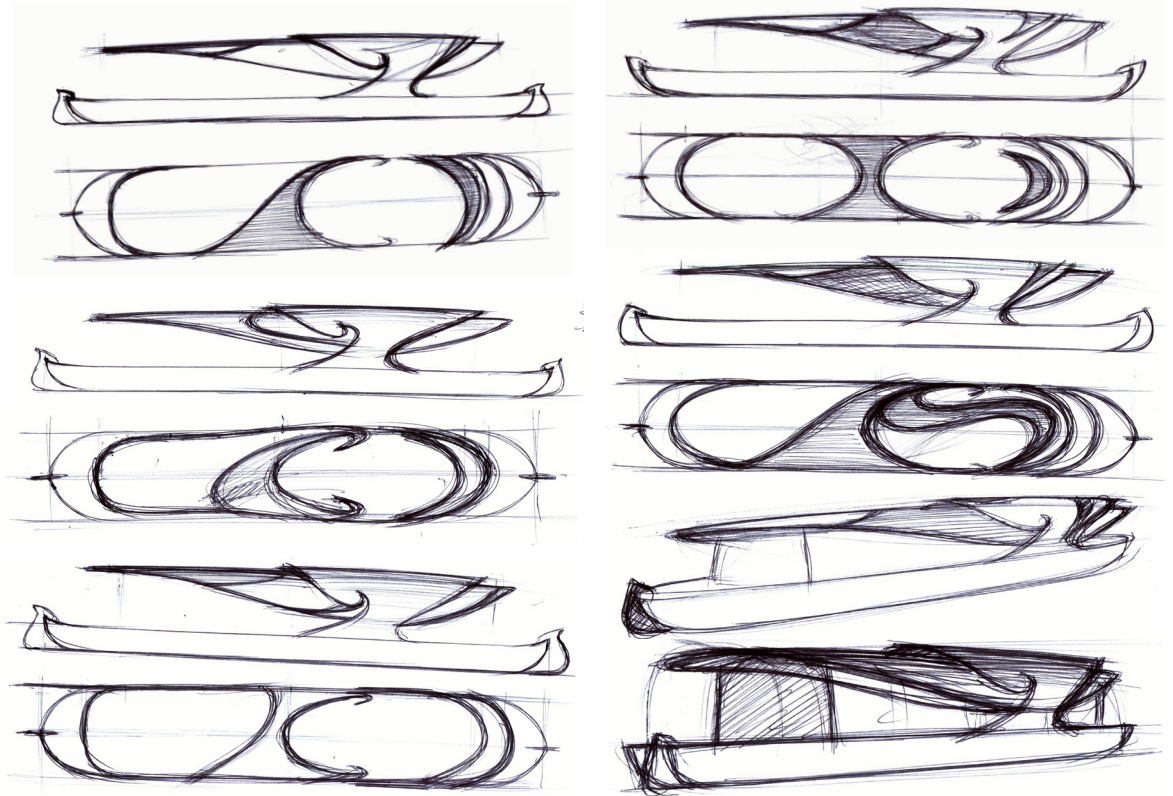
Direction 3

This direction was developed based on the idea of have the second roof more towards the front of the boat. Here, the lower canopy takes up the dominant role and the upper roof is the sub-dominant element. The location of the 2nd roof reduced the pace with which the dominant roof appeared to move. The DLO patterns were worked out in such a way that a single DLO element cuts through both the roofing elements



Direction 4 - Final direction

Inspired from highly traditional Kerala patterns, the form was developed using organic curves which appear to grow out from the hull structure. The DLO design follows on the similar lines and creates a very dynamic impact on the overall form.



5.4 Final Design

5.4. a INTERIORS

The concept selected via user evaluation was detailed out to produce the final design.



Entry and lounge

Entry from the port side is to the deck of the boat. The user is then led to a lounge space which has a winding pathway leading to the mid and rear of the boat. The lounge space consists of an amphitheater seating, a low seating and a dining space.



The deck space doubles up as a performance arena for cultural performances. Along with this, a touch of technology is introduced as the boat AI communicates with the user via voice and interface screens. A live location, weather and news widget floats on the smart-screen near the lounge space. Each separate space in the boat has a smart screen within it, so that the user can be in constant touch with the AI.



Bedroom

The flowing lines of the boat continue into the bedroom as well. A king size bed and a multi-functional low deck has been provided to the user.



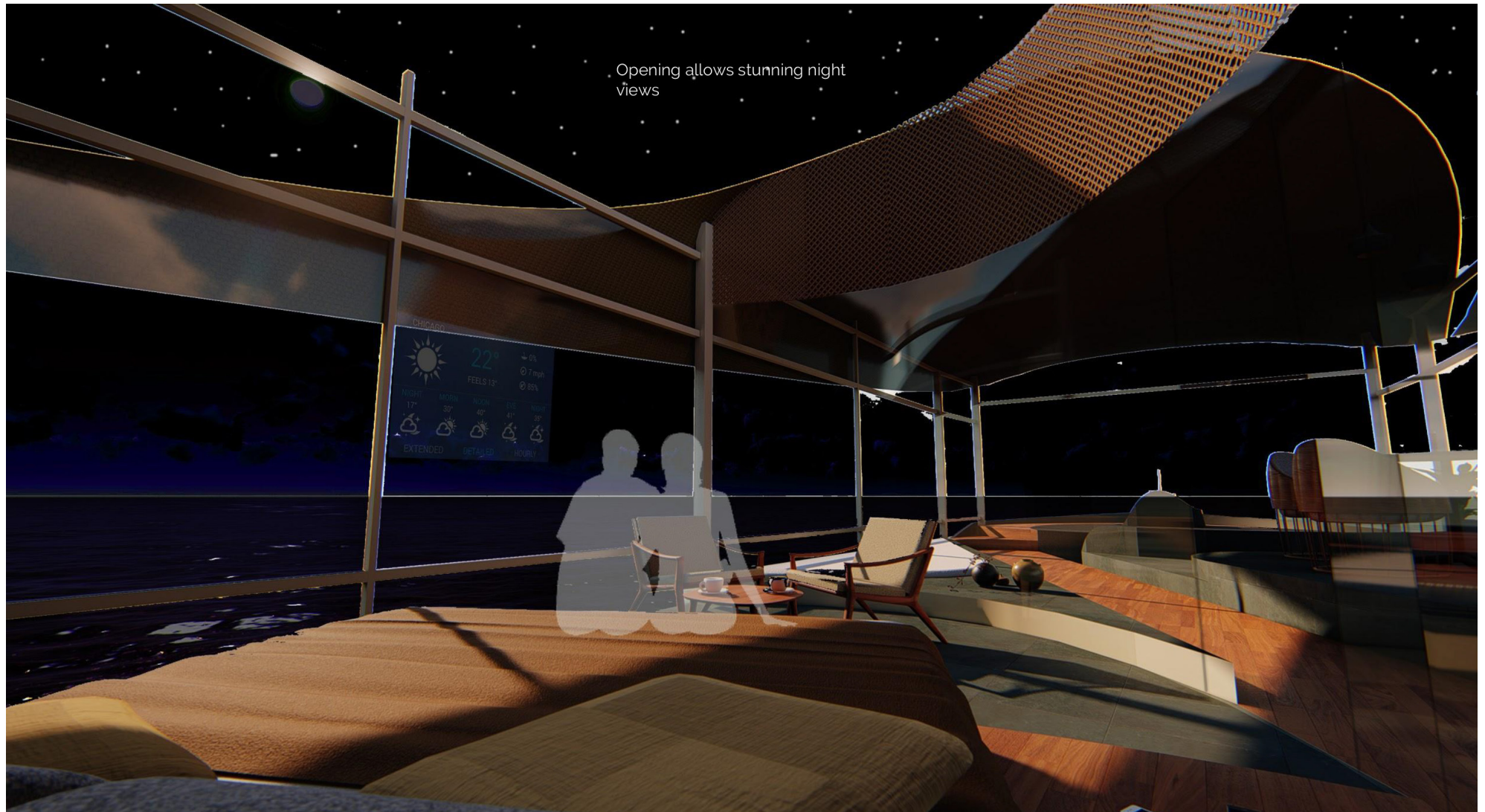
The bedroom offers a good view of the scenery from within its premises. The free flowing skylight brings in an extra spatial feel to the area



The opacity of the smart glass can be controlled to make it opaque or transparent as per need of the user. This helps in setting a visual privacy when required. The smart screen wall doubles up as an entertainment screen if the user wants.



Exquisite night views can be enjoyed from the bedroom.



Passage to the rear of the boat



Passage opens out into the kitchen area



Pathway opens up into the kitchen space with a high stool seating

Open kitchen with a rustic feel to it



Ayurvedic massage space

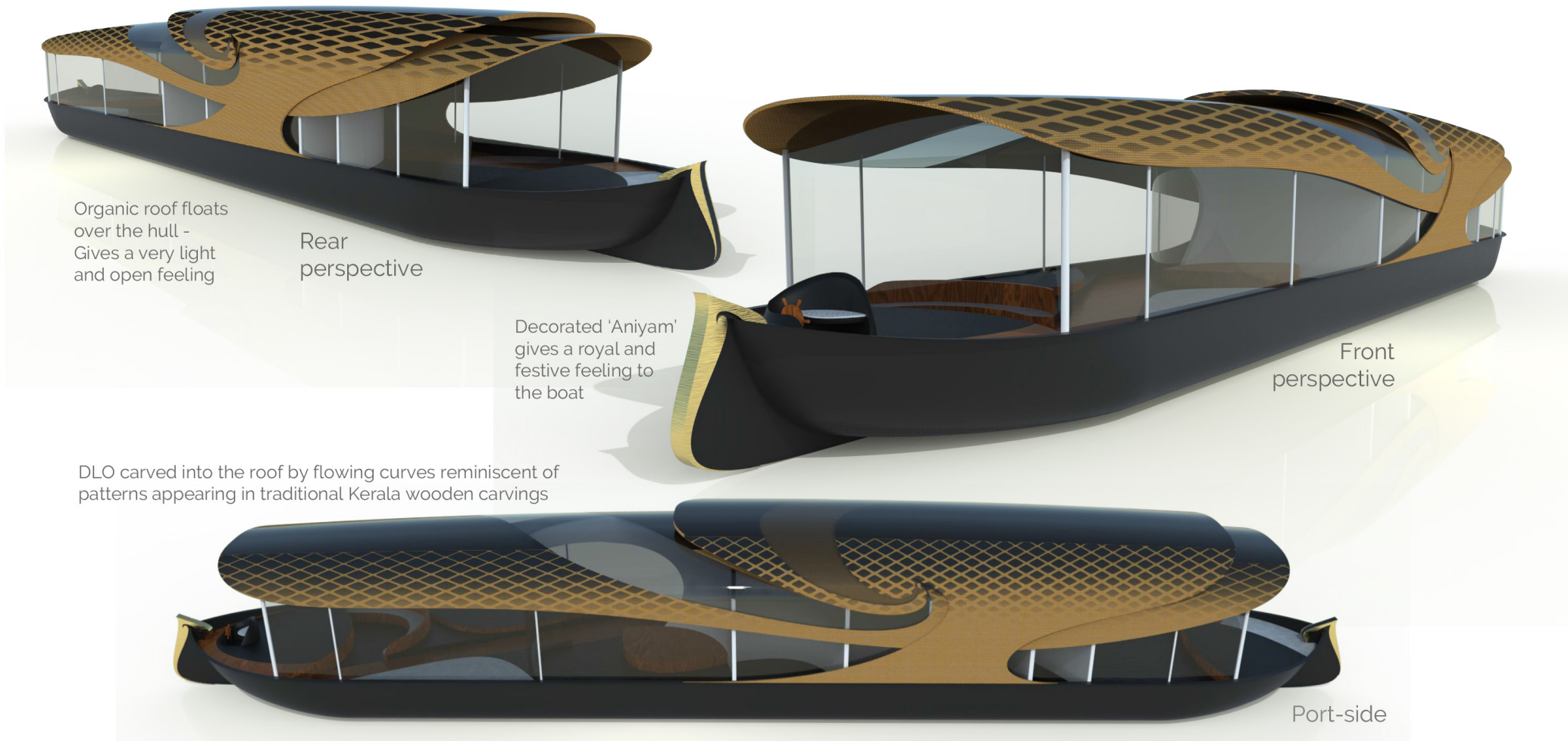


Rear deck

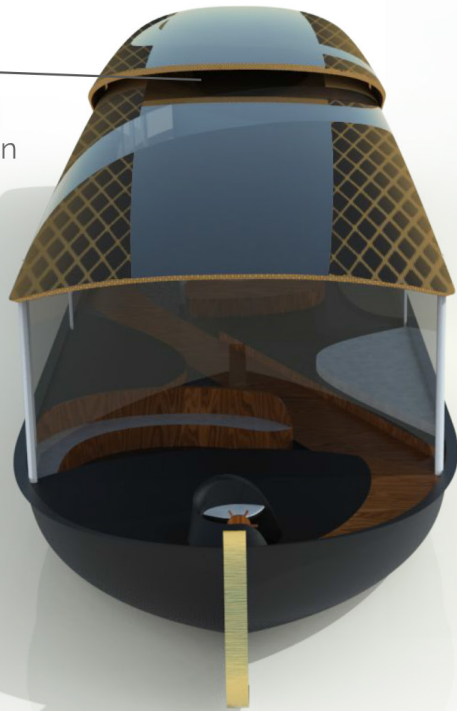


5.4. b EXTERIORS

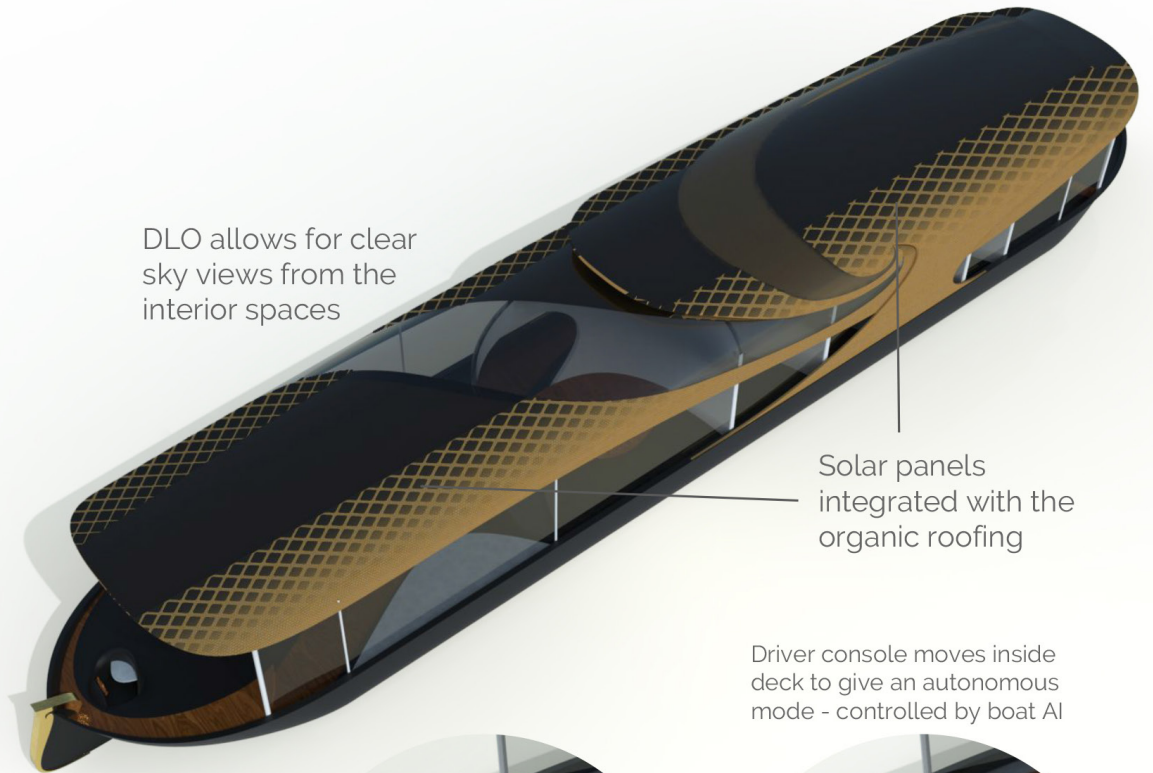
The finalized direction was detailed out to develop the design



Double roof allows for cold air to pass through the roofs creating a draft and helping in ventilation from toilets



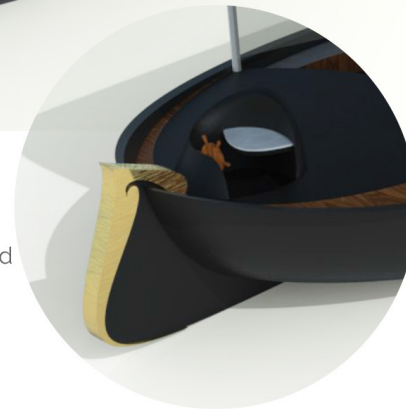
DLO allows for clear sky views from the interior spaces



Solar panels integrated with the organic roofing

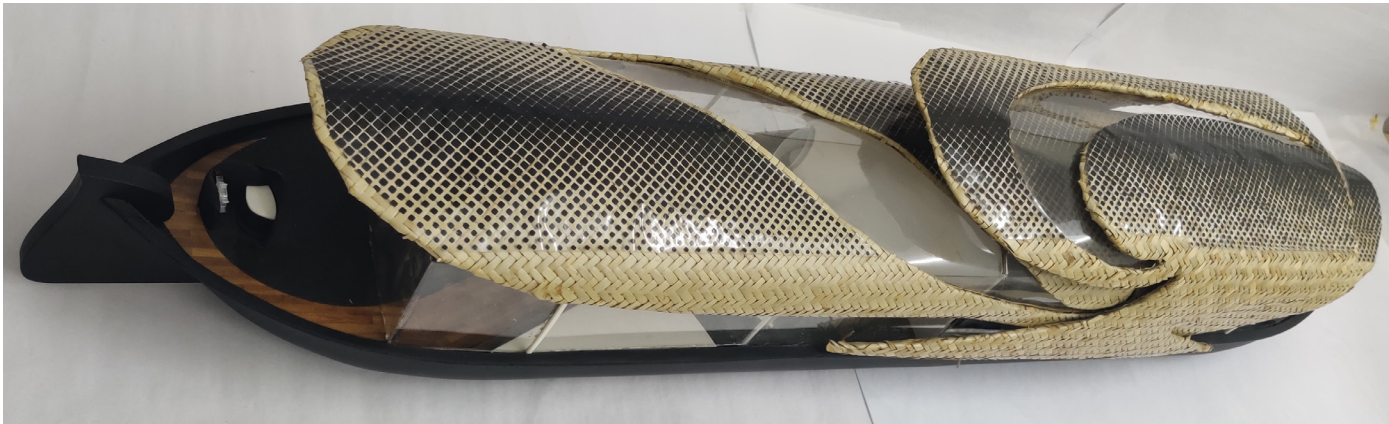
Driver console moves inside deck to give an autonomous mode - controlled by boat AI

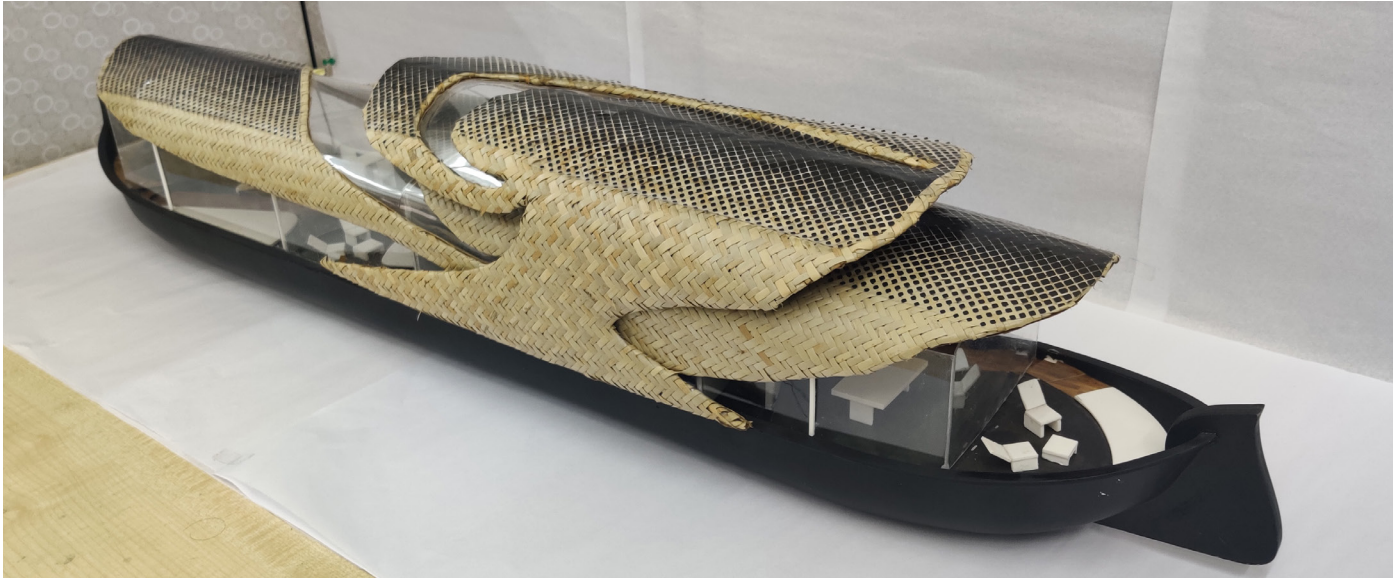
Front deck seats the driver cocooned in an organically shaped seating and console unit





6. FINAL MODEL





6. ANNEXURE

6.1 User research kit

6.1.a Part A - Basic Info

Name

Age

Location

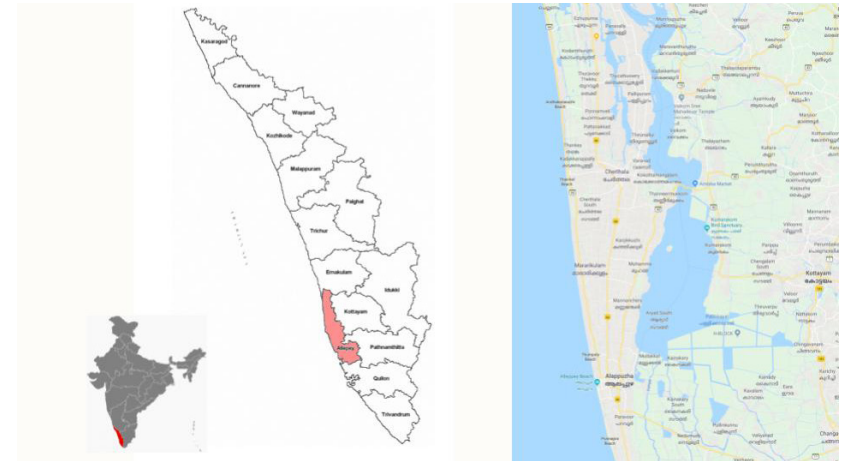
Profession

Income

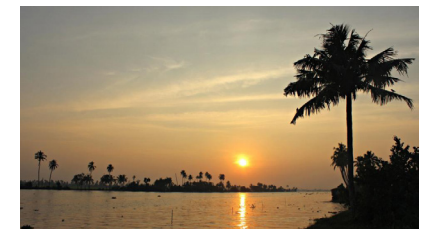
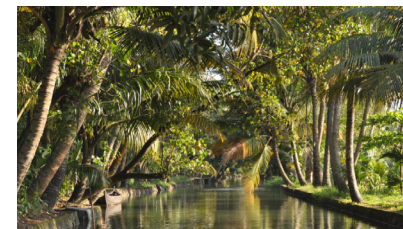
This will help develop an initial connection with user. The questions will also help to understand the demography - from where would he/she travel, how much time can be spent on vacation, how much can they afford?

6.1.b Part B - Priming

The users are given info about the backwater scenario and show cards are shown which will help them relate to the location more. The visuals shown will trigger some emotion within the user which will form a base for his narrative.



Img 104. Map showing the primary location in which the design context is set



Img 105, 106. Images showing the locations present in backwaters



Img 107, 108. Images showing the locations present in backwaters

6.1.c Part C - Task 1

“If you’re spending a holiday here, who would you like it to be with?”

Family

Friends

Romantic trip

Solo

Business retreat

This will create a basic setting for the narrative. The user will further develop his story and experience based on this setting.

“Pick a spot where you’d like to spend maximum time in this setting”

An image showing the prime location of backwater tourism in Alleppey is shown to them and they are asked to pick a spot where they’d like to spend maximum time at. This will give us a clue as to whether the user prefers a completely isolated setting, or one which has proximity to land, or one in which he has other tourists for company.



Img 109. Panoramic image of the primary location from which the user has to pick his spot

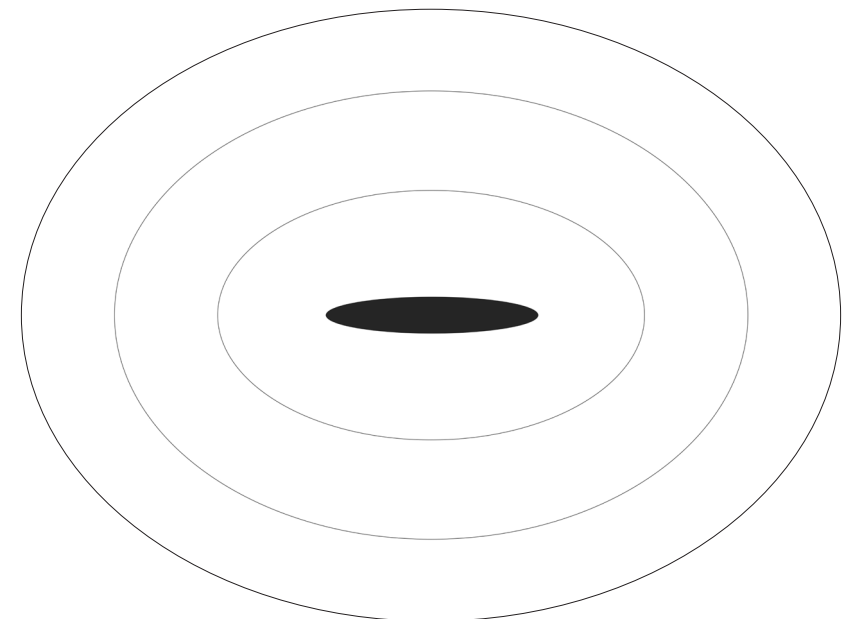
6.1.d Part C - Task 2

In this task, a diagram with the symbolic image of a boat is given with 3 concentric rings depicting proximity to the boat. A set of 7 images are given to the user. These images feature the primary views which are available in the backwater setting. The task for the user is to arrange these views in the boat diagram based on the proximity - physical or visual, and general direction in which they want these views to be experienced from. It is not necessary for the users to pick all the view cards in this task. They can choose and prioritize on their own.

This task was designed to give us feedback on what kind of visual and physical experience the user wants to surround himself with while inside the boat.



Img 109-115. Images showing various views available at the backwaters



Img 116. Diagram in which user has to set his views

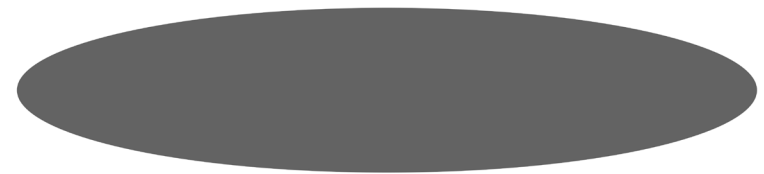
6.1.e Part C - Task 3

A diagram showing the schematic plan of a boat is given along with cards with various spaces written on it. The task of the user is to pick out spaces which he finds relevant in his boat and to set them based on where he needs those spaces to be.

While setting up the spaces, the user will inadvertently arrange them based on the primary experience he wants.

DECK	LOUNGE	DINING	BEDROOM	KITCHEN	BEDROOM	SPA
DECK	PARTY	BARBEQUE	BEDROOM	TOILET	GAMES ROOM	

Img 117. Cards showing the various spaces offered to the user



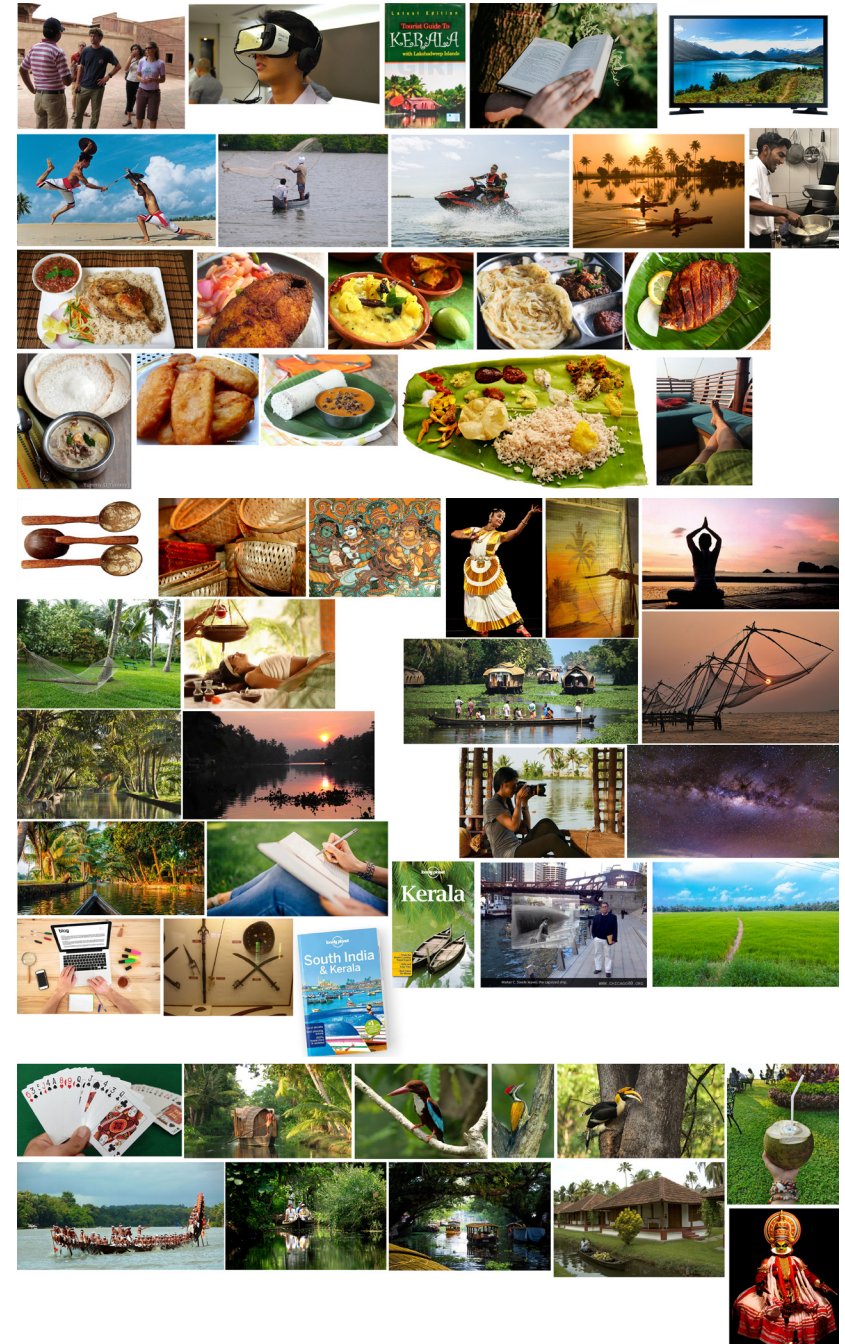
Img 118. Schematic plan in which user has to setup his spaces

6.1.f Part C - Task 4

The final task deals with word associations. The user is given a list of 10 words which are related to holidays and vacation. He is asked to pick out words which he find relevant to his scenario and has to pick out and place images from a selection given to him. These images have to be picked and placed based on word he can associate it with from the list of words he selected. The selection of images have been made based on relevance to the project setting and context.

- Adventure
- Relaxation
- Explore
- Guide
- Recreation
- Scenery
- Sharing
- Culture
- Entertainment
- Food

This task will give us a qualitative and quantitative result which will bring out what the user expects from a holiday in the backwaters, what is of importance to him and how he sees these priorities based on the images he picks.



Img 119. Image selection for the word association exercise

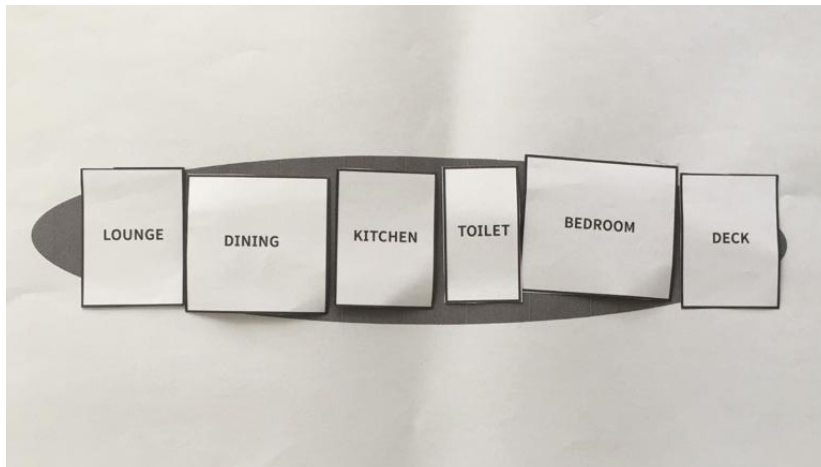
6.2.b USER 2

Female, 18 yo

Prefers to go on solo trip



Img 123. Task 2



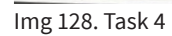
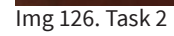
Img 124. Task 3



Img 125. Task 4

Female, 35 yo
Prefers to go on family trip

Prefers to go on family trip



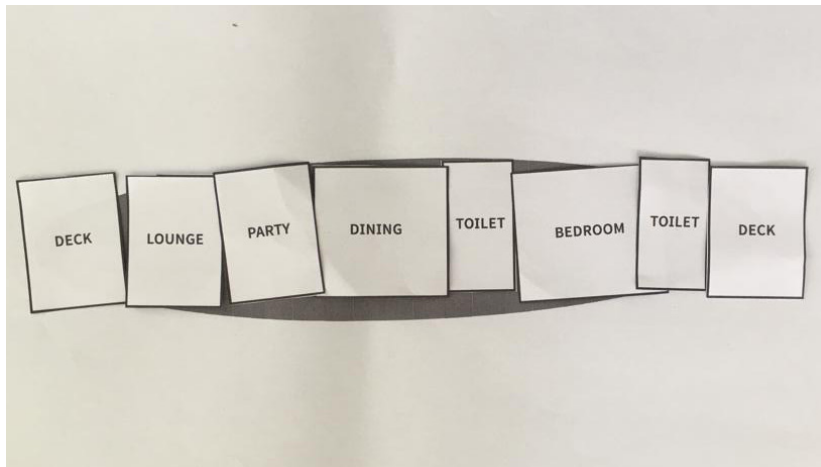
6.2.d USER 4

Male, 20 yo

Prefers to go on trip with friends



Img 129. Task 2



Img 130. Task 3

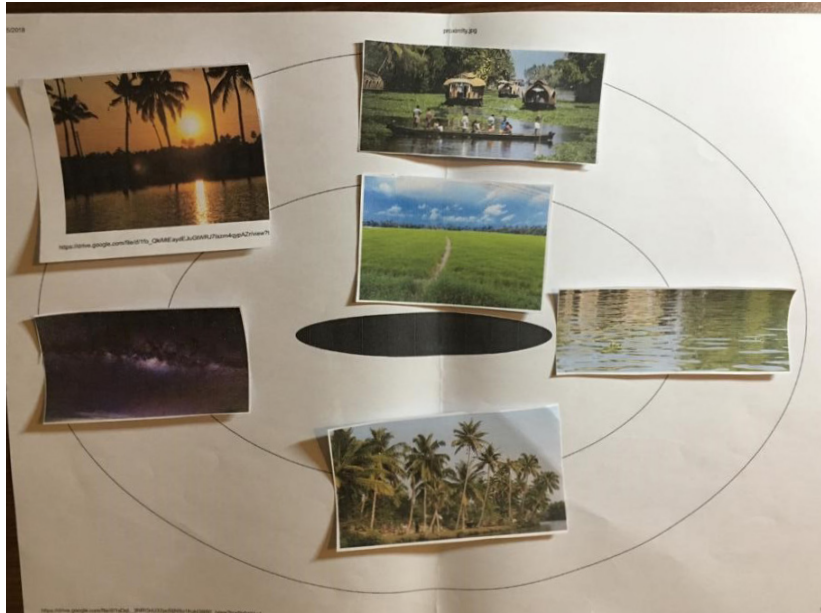


Img 131. Task 4

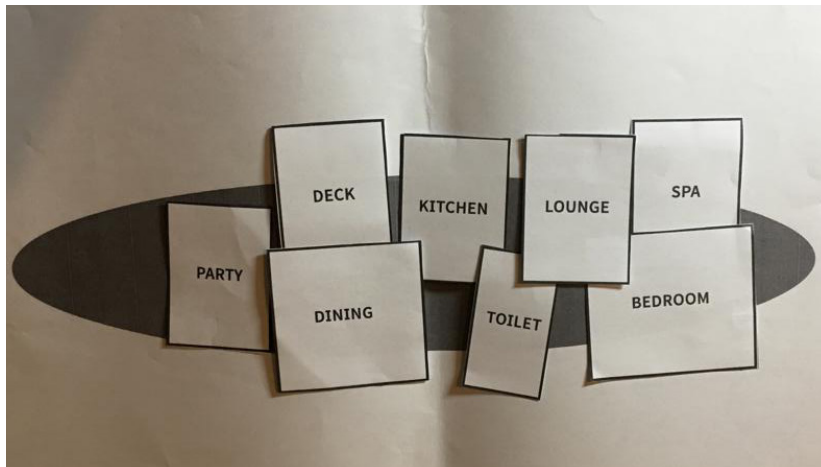
6.2.e USER 5

Female, 26 yo

Prefers to go on family trip



Img 132. Task 2



Img 133. Task 3



Img 134. Task 4

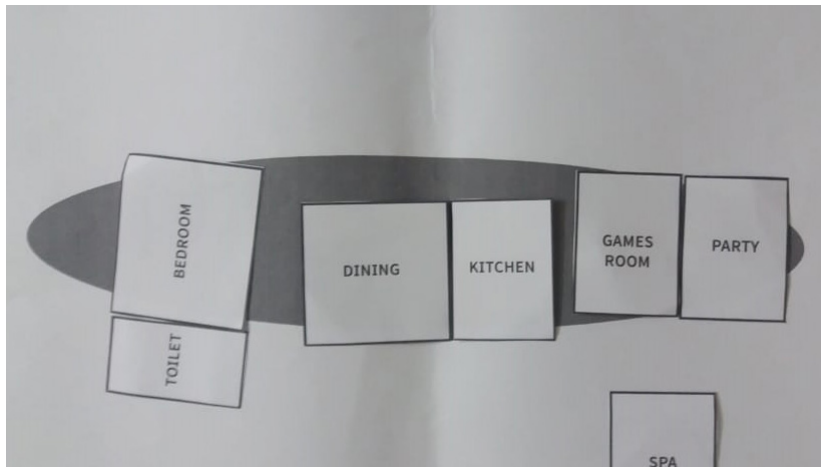
6.2.f USER 6

Female, 20 yo

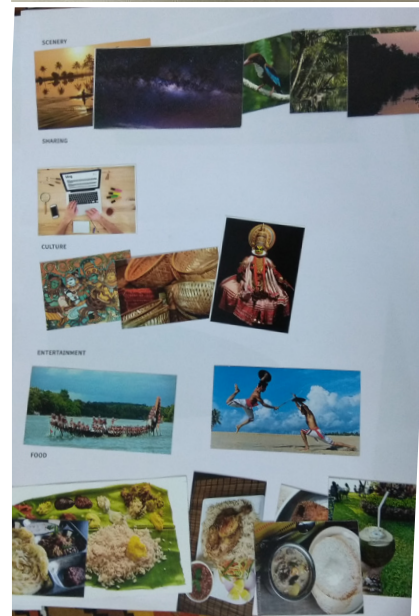
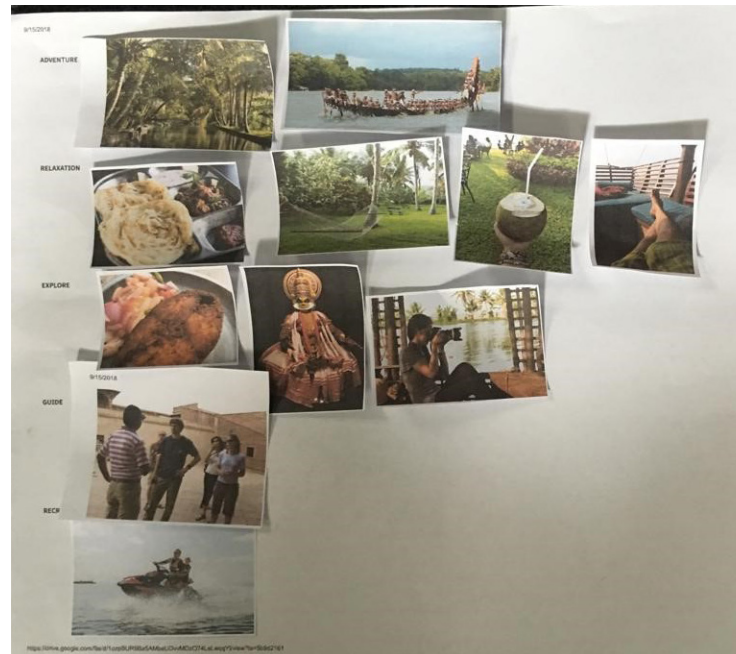
Prefers to go on romantic trip



Img 135. Task 2



Img 136. Task 3



Img 137. Task 4

6.2.g USER 7

Female, 23 yo

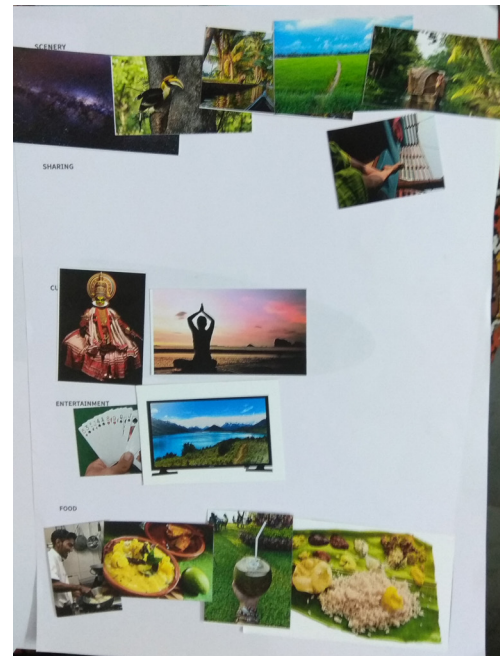
Prefers to go on solo trip



Img 138. Task 2

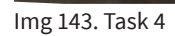
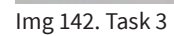
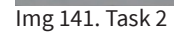


Img 139. Task 3



Img 140. Task 4

Male, 22 yo
Prefers to go on solo trip



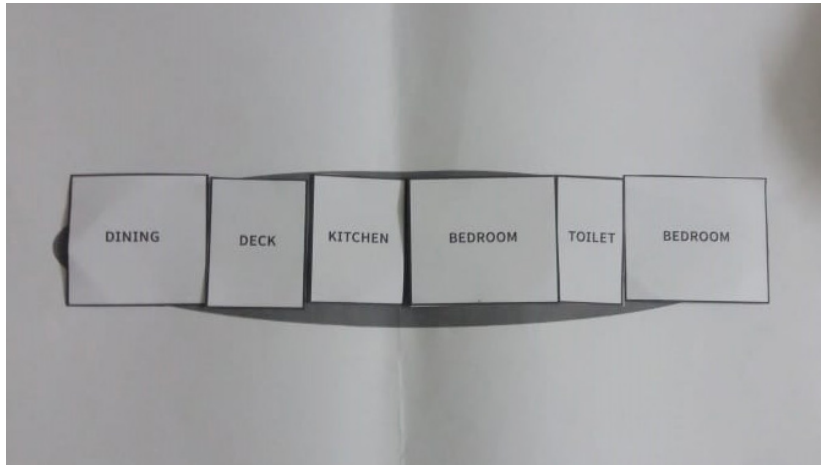
6.2.i USER 9

Male, 26 yo

Prefers to go on family trip



Img 144. Task 2



Img 145. Task 3



Img 146. Task 4

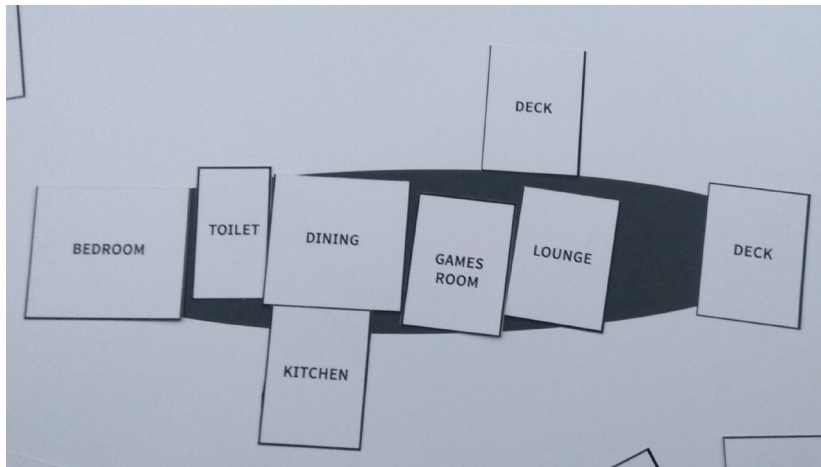
6.2.j USER 10

Male, 28 yo

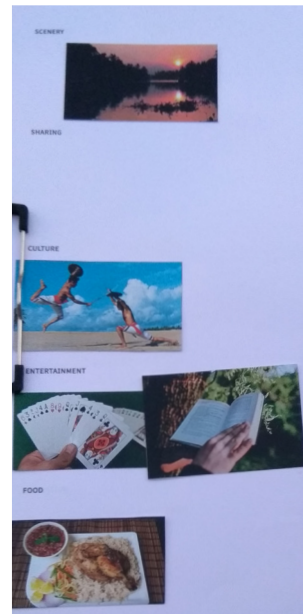
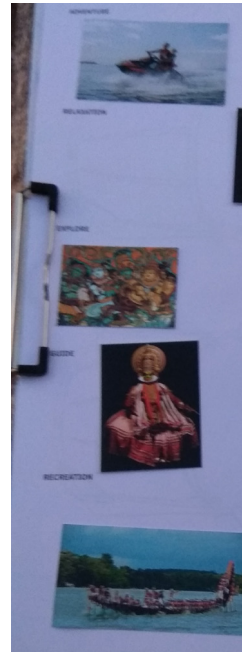
Prefers to go on romantic trip



Img 147. Task 2



Img 148. Task 3

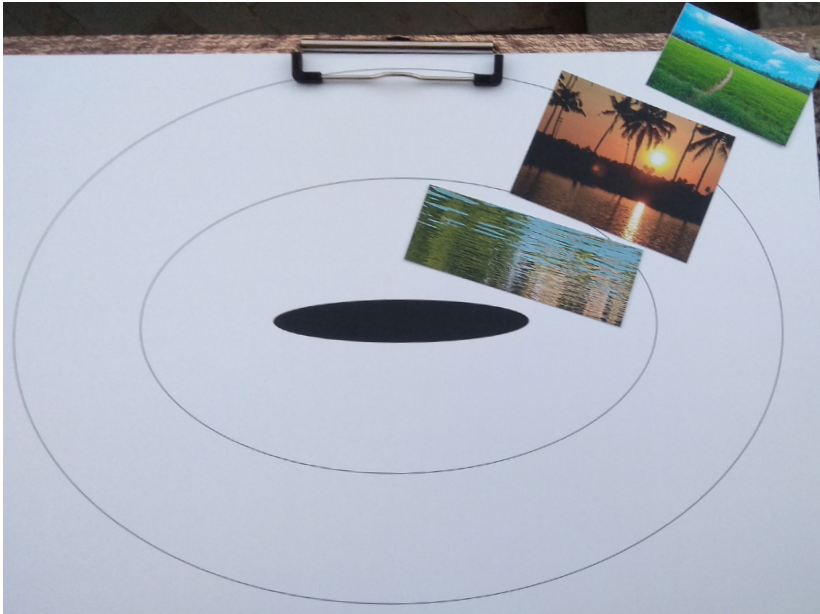


Img 149. Task 4

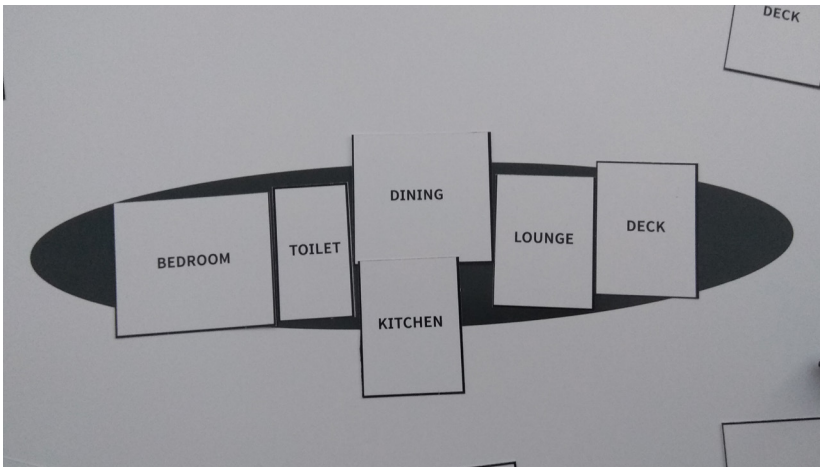
6.2.k USER 11

Male, 27 yo

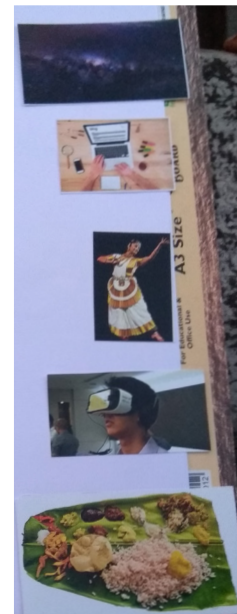
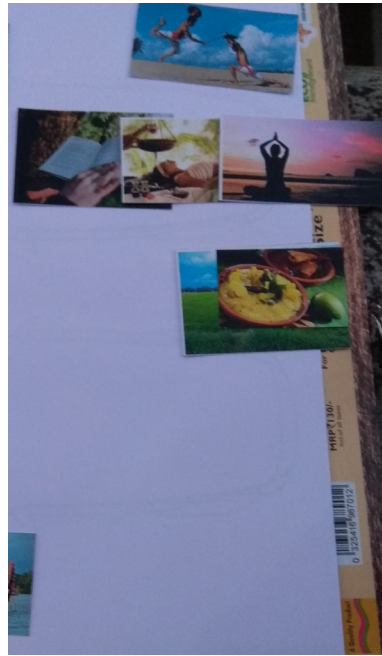
Prefers to go on solo trip



Img 150. Task 2



Img 151. Task 3



Img 152. Task 4

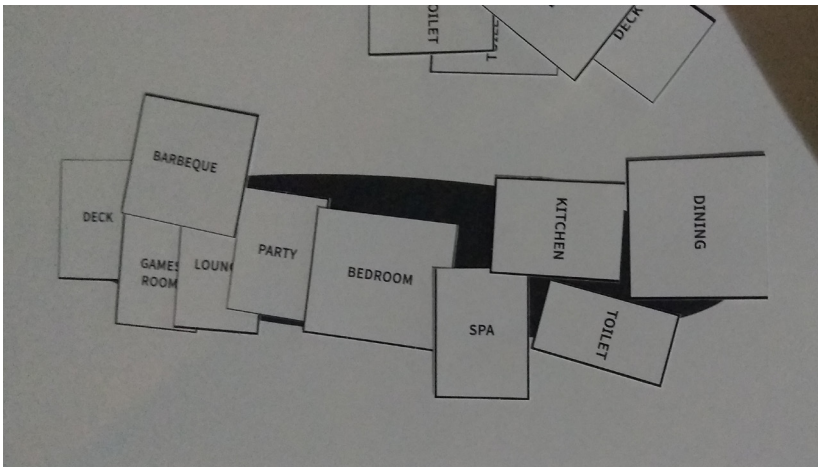
6.2.I USER 12

Male, 28 yo

Prefers to go on romantic trip



Img 153. Task 2



Img 154. Task 3

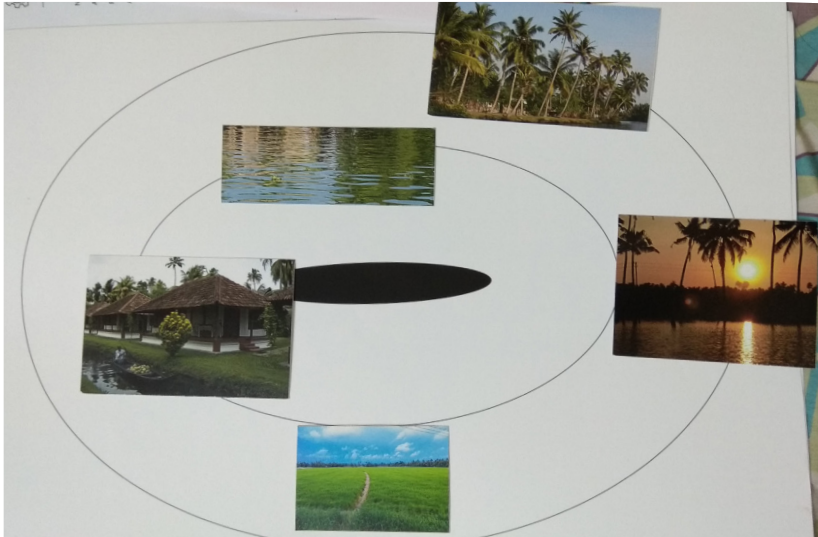


Img 155. Task 4

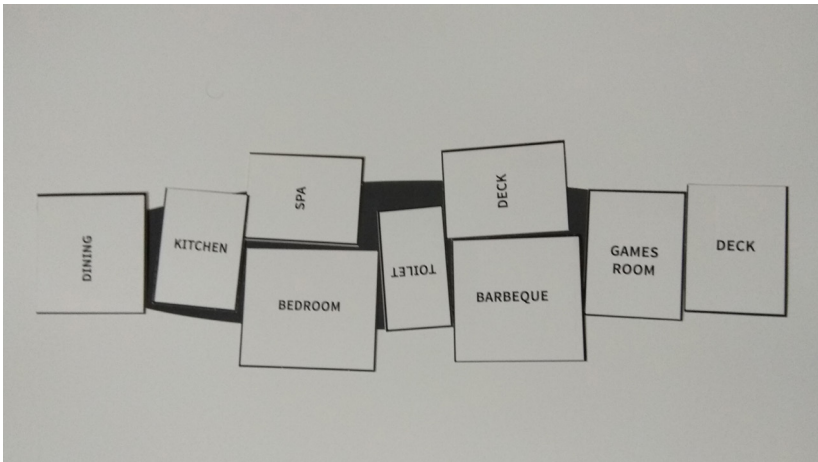
6.2.m USER 13

Male, 32 yo

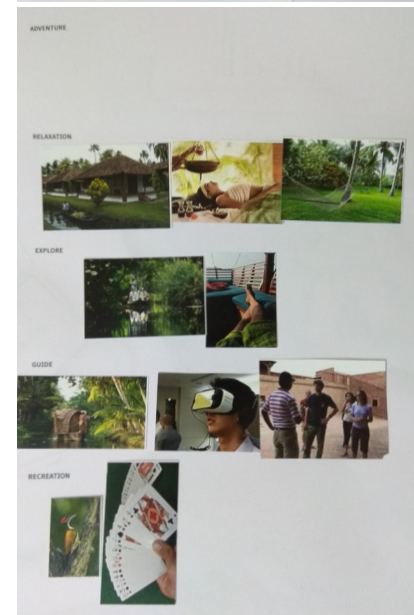
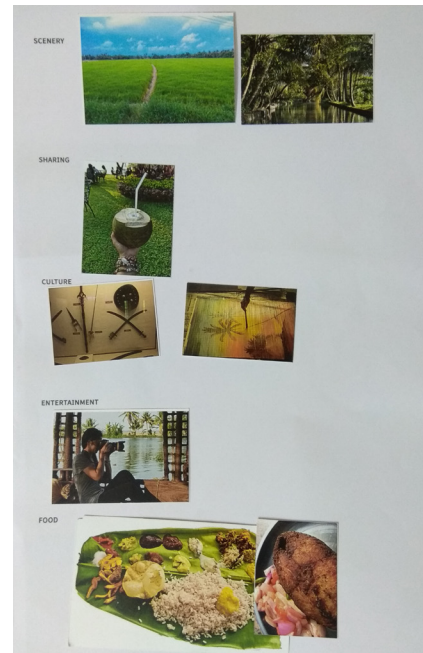
Prefers to go on family trip



Img 156. Task 2



Img 157. Task 3



Img 158. Task 4

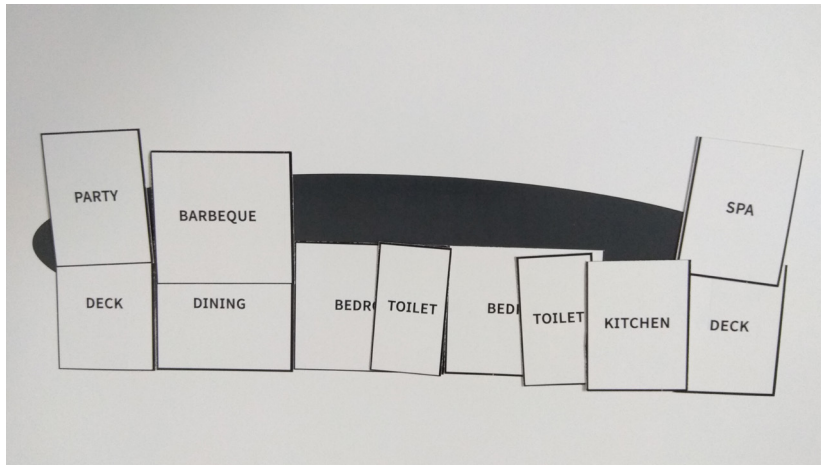
6.2.n USER 14

Male, 32 yo

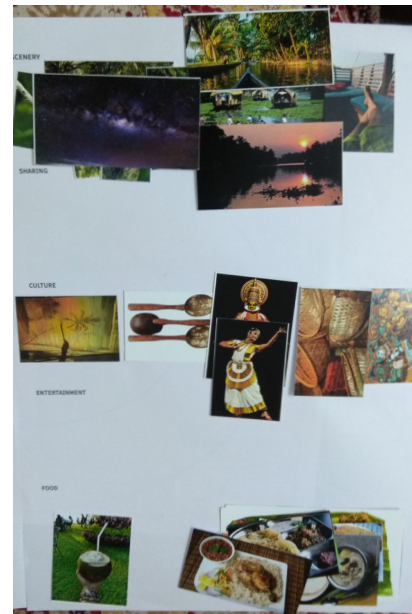
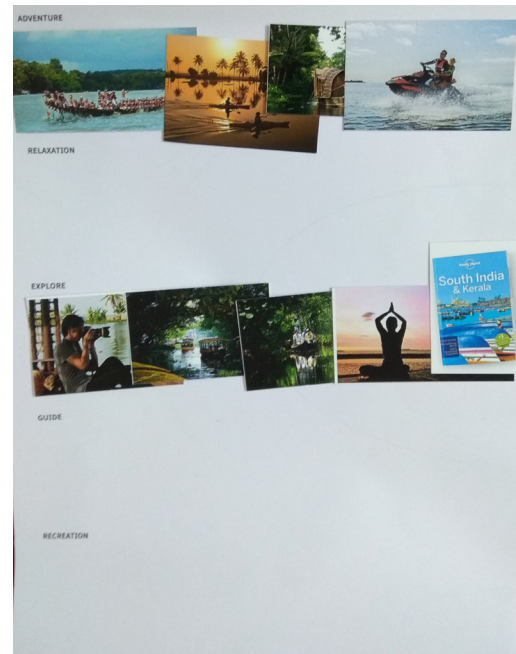
Prefers to go on solo trip



Img 159. Task 2



Img 160. Task 3



Img 161. Task 4

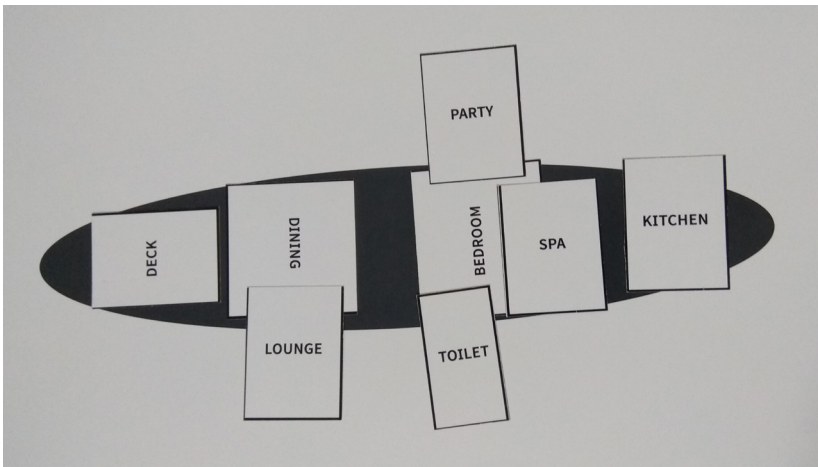
6.2.o USER 15

Female, 38 yo

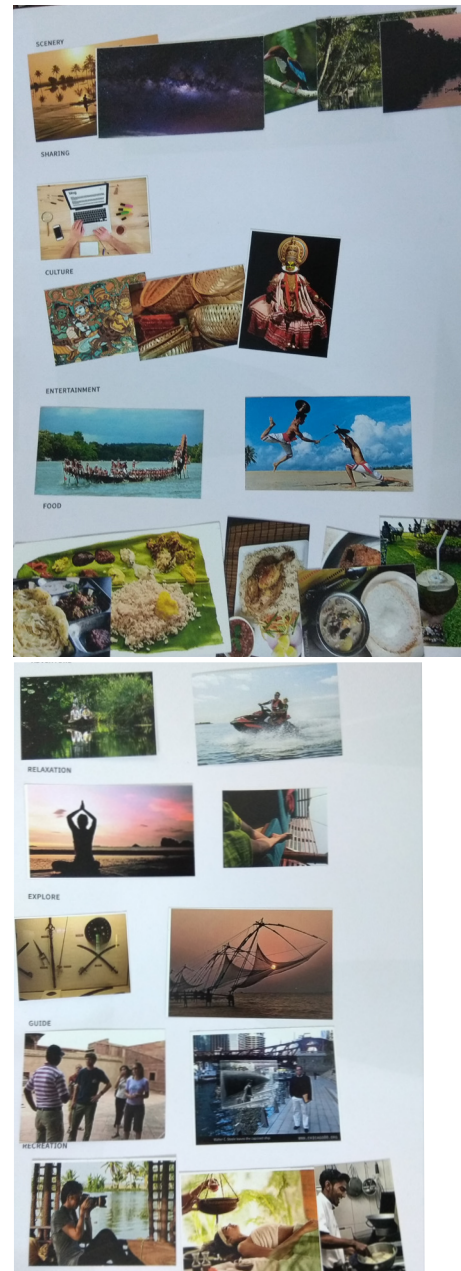
Prefers to go on a family trip



Img 162. Task 2



Img 163. Task 3



Img 164. Task 4

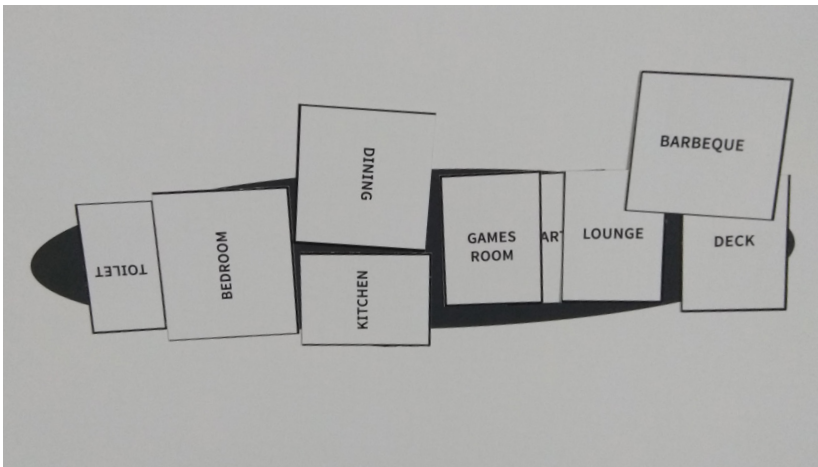
6.2.p USER 16

Female, 26 yo

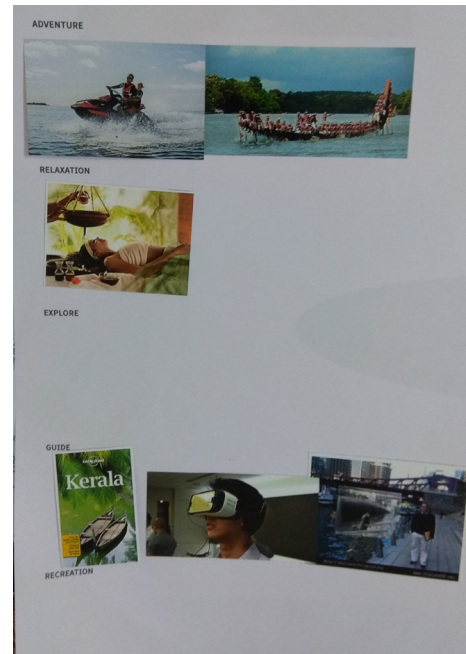
Prefers to go on romantic trip



Img 165. Task 2



Img 167. Task 3



Img 168. Task 4

7. BIBLIOGRAPHY

- 1 Backwaters and rivers. *Informationaboutkerala.blogspot.com*, Sept 2017, <https://informationaboutkerala.blogspot.com/2017/09/backwaters-rivers-backwaters-are.html>
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