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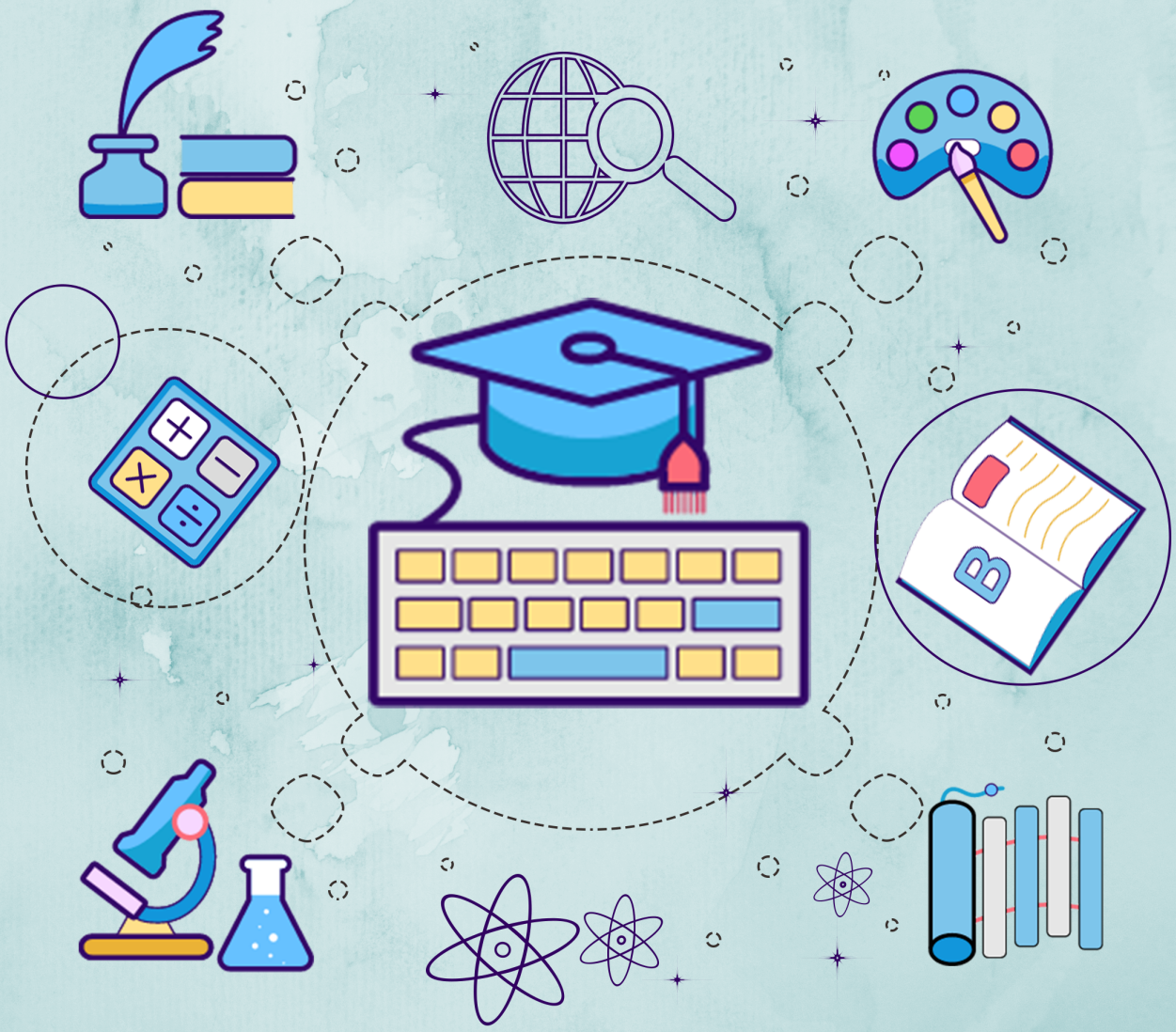

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DESIGN AND ENGINEERING (EST 200)

Module 2

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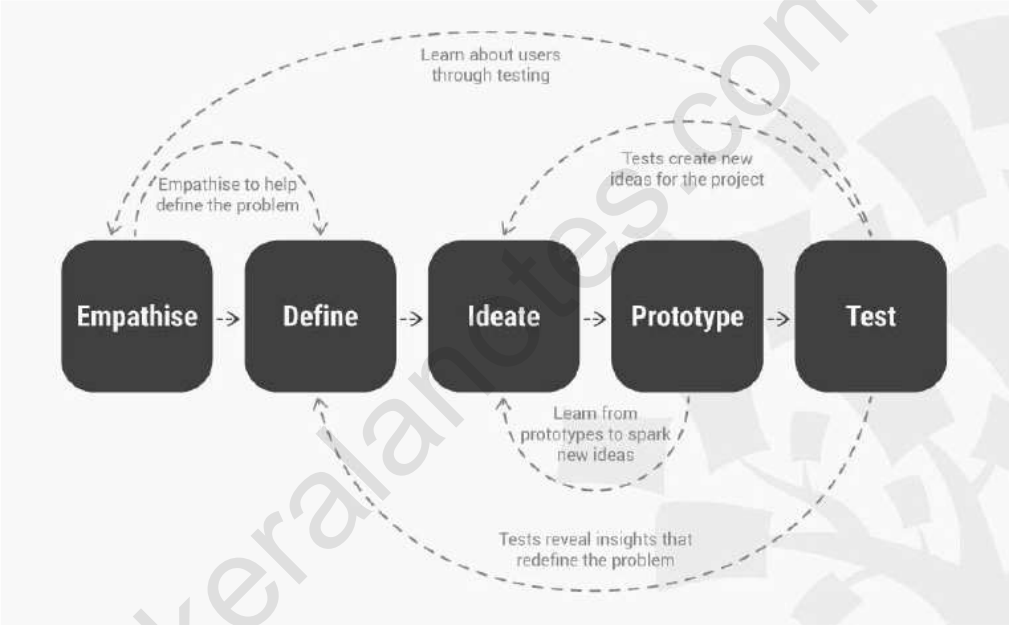
Module 2: Design & Engineering

Background

Design thinking approach

Design Thinking is a "process for creative problem solving." It's an approach, typically applied in a Design Thinking workshop, that anyone (not just designers!) can take to solve a business or creative challenge. While there are different approaches to the Design Thinking depending on who is teaching it, the process typically boils down to the following five steps:

1. Empathize
2. Define
3. Ideate
4. Prototype
5. Test.



Empathize - Research Your Users' Needs

- First stage of the design thinking process.
- you should gain an empathetic understanding of the problem you're trying to solve, typically through user research.
- Empathy is crucial to a human-centered design process such as design thinking because it allows you to set aside your own assumptions about the world and gain real insight into users and their needs.
- Depending on time constraints, a substantial amount of information is gathered at this stage to use during the next stage and to develop the best possible understanding of the users, their needs, and the problems that underlie the development of that particular product.

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Define - State Your Users' Needs and Problems

- During the Define stage, you put together the information you have created and gathered during the Empathize stage.
- Then analyze your observations and synthesize them to define the core problems you and your team have identified up to this point
- These definitions are called problem statements.
    - Problem statements are concise descriptions of design problems.
    - Design teams use them to define the current and ideal states, to freely find user-centered solutions.
    - Synthesize your observations about your users from the Empathize stage
    - Definition of a meaningful and actionable problem statement, which the design thinker will focus on solving

Ideate - Challenge Assumptions and Create Ideas

- You are now ready to generate ideas
- The solid background of knowledge from the first two phases means you can start to "***think outside the box***", look for alternative ways to view the problem and identify innovative solutions to the problem statement you've created.
- It is important to get as many ideas or problem solutions as possible at the beginning of the Ideation phase.
- Brainstorming is particularly useful here.
    - Brainstorming is a method design teams use to generate ideas to solve clearly defined design problems.
- You should pick some other Ideation techniques by the end of the Ideation phase to help you investigate and test your ideas so you can find the best way to either solve a problem or provide the elements required to circumvent it.

Prototype - Start to Create Solutions

- This is an experimental phase.
- The aim is to identify the best possible solution for each problem found.
- Prototypes may be shared and tested within the team itself, in other departments, or on a small group of people outside the design team.
- Team should produce some inexpensive, scaled-down versions of the product (or specific features found within the product) to investigate the ideas you've generated.
- The solutions are implemented within the prototypes, and, one by one, they are investigated and either accepted, improved and re-examined, or rejected on the basis of the users' experiences.

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- By the end of this stage, the design team will have a better idea of the constraints inherent to the product and the problems that are present, and have a clearer view of how real users would behave, think, and feel when interacting with the end product.

Test - Try Your Solutions Out

- This is the final stage of the 5 stage-model, but in an iterative process, the results generated during the testing phase are often used to redefine one or more problems and inform the understanding of the users, the conditions of use, how people think, behave, and feel, and to empathise.
- Evaluators rigorously test the prototypes
- Although this is the final phase, design thinking is iterative: Teams often use the results to redefine one or more further problems.
- Can return to previous stages to make further iterations, alterations and refinements – to find or rule out alternative solutions.
- Even during this phase, alterations and refinements are made in order to rule out problem solutions and derive as deep an understanding of the product and its users as possible.
- Chance to gather feedback, refine solutions, and continue to learn about your users.
- The test mode is an iterative mode in which you place low-resolution prototypes in the appropriate context of your user's life.
- Prototype as if you know you're right, but test as if you know you're wrong

Convergent and divergent thinking

Divergent thinking

- It is a thought process or method used to generate creative ideas by exploring many possible solutions.
- It typically occurs in a spontaneous, free-flowing, "non-linear" manner, such that many ideas are generated in an emergent cognitive fashion.
- Divergent thinking uses the imagination to open the mind to new possibilities and solutions, and ultimately become more innovative.

Convergent thinking

- It is the opposite of divergent thinking.
- It generally means the ability to give the "correct" answer to standard questions that do not require significant creativity, for instance in most tasks in school and on standardized multiple-choice tests for intelligence.
- Convergent thinking moves from broad thoughts to concrete understanding, where the thoughts from divergent thinking can be narrowed down to the most promising ideas and solutions.

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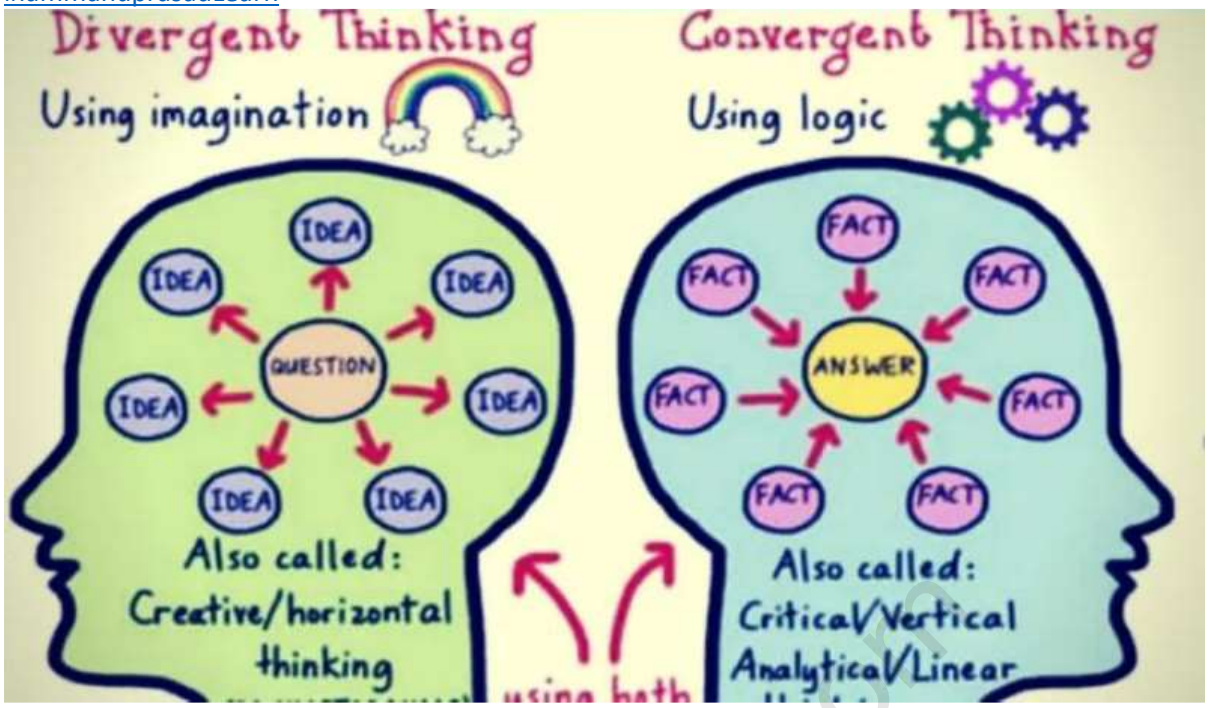

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Q1) Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

Solution:

Step 1: Empathize: Research your user's need

In this stage we are trying gain an empathetic understanding of the problem you're trying to solve, typically through user research.

- Bag should carry books
- Bag should carry tiffin box
- Bag should carry water bottle
- Bag should carry pen, pencil and other accessories
- Zipper breaks most of the time
- Shoulder got pain when carries for more time
- Laptop must carry section must be there and there must be protected
- Items get wet on a rainy day
- Bag won't last long

Step 2: Define: user's need and problems

P1) sections must be there for books, laptop, tiffin box, pen, water bottle

P2) Zipper and bag breaks most of the time

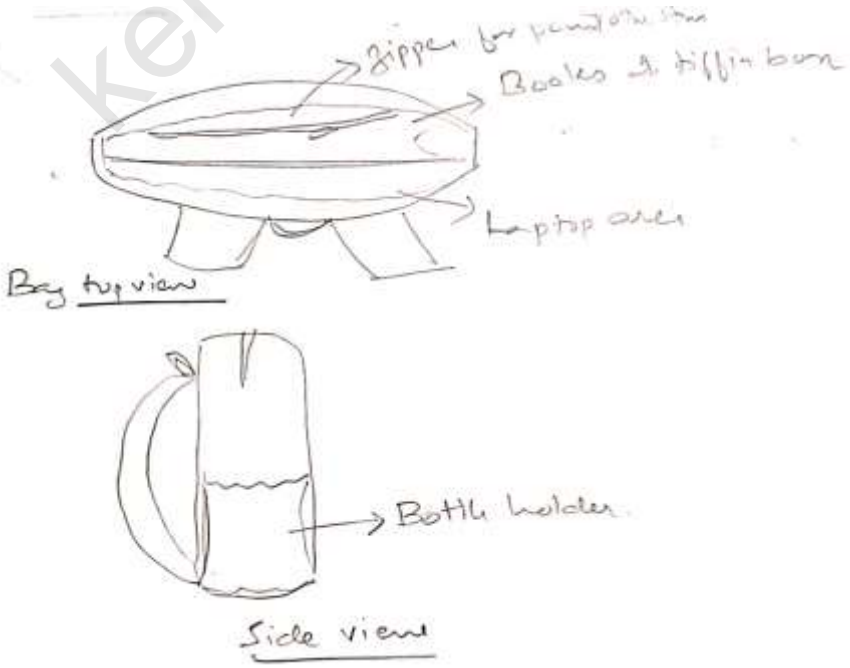
P3) shoulder and back pain if carry bag for more time

P4) Extra safety for laptop

P5) Items get we on a rainy day

Step 3: Ideate: create idea for the problem

P1)



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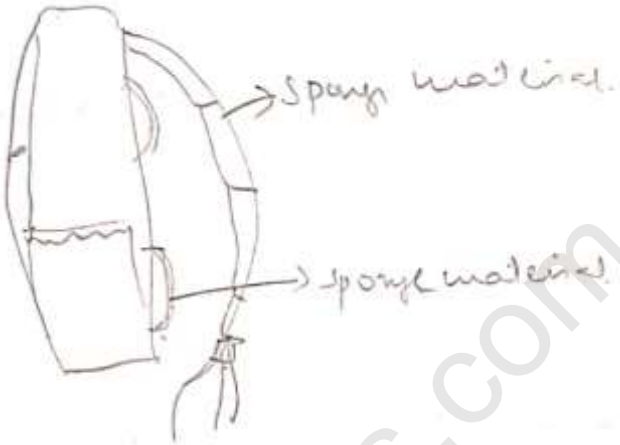
P2)

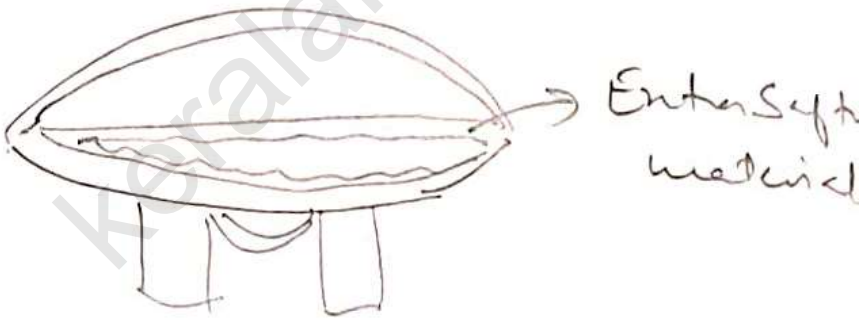
- Better zipper material must be used like steel for long lasting
- Good and long-lasting bag material can be used
- Better stitching material can also be used

P3)

- Adding good cushions and sponge material at the shoulder strap for reduce shoulder pain
- Can reduce the back pain by adding cushion material on the back side



P4) extra safety for laptop can be added to laptop carry area by adding extra sponges and good material



P5)

- To protect the bag from getting wet on a rainy day the bag can have a special rain coat
- The rain coat can be placed in small section under the bag when it is in not use

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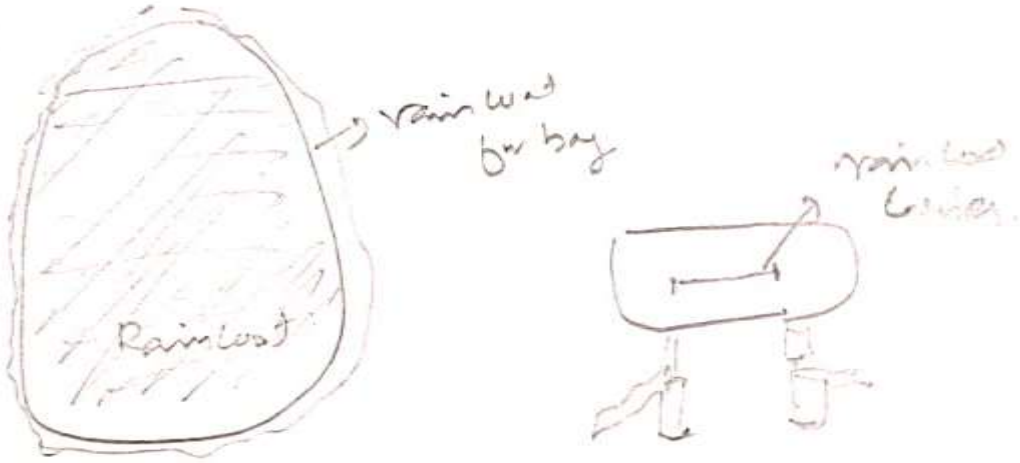

Step 4: Prototype: solution for the ideas

Step 5: Test: Try the solution

- In this step we can give the prototype that we made from our design to some college students and tell them to use that for some time and collect the feedback from them
- And from the feedback we can improve our design if we want

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2) Construct a number of possible designs and then refine them to narrow down to the best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Solution

Objective: To design a drug trolly

Scope/domain: Hospitals and health care centres

Users: Hospital staffs

Model 1:

Pros:

- Simple and Light weight
- Easier to keep medicines and boundaries are provided in all 3 sides which prevents from medicines falling down while moving.

Cons:

- Difficult to sort out medicines for each room.
- No doors for racks and no open table.
- Wheels have no locks

Model 2:

Pros:

- Simple and Light weight
- Easier to keep medicines

Cons:

- Difficult to sort out medicines for each room.
- No doors for racks and no open table.
- Wheels have no locks
- As there are no boundaries, there is a high chance of falling down the medicines while moving.

Model 3:

Pros:

- Simple and Light weight
- Easier to keep medicines as boundaries and lids are there for each rack.

Cons:

- Difficult to sort out medicines for each room.
- Wheels have no locks

Model 4:

Pros:

- Simple and Light weight
- Easier to keep medicines as drawers are used.
- An open table is there on the top to keep case diary/charts of patients.
- Wheels have locks

Cons:

- Difficult to sort out medicines for each room.
- No option for disposing clinical wastes.

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Model 5:

Pros:

- Simple and Light weight
- Easier to keep medicines as drawers are used.
- An open table is there on the top to keep case diary/charts of patients.
- Have both open and closed racks to keep drugs accordingly.

Cons:

- Difficult to sort out medicines for each room.
- No option for disposing clinical wastes.
- No lock for wheels

Model 6:

Pros:

- Simple and Light weight
- Easier to keep medicines and sort out medicines for each patient as different partitions are provided for each room.
- Have both open and closed racks to keep drugs accordingly.

Cons:

- No open table is there on the top to keep case diary/charts of patients
- No option for disposing clinical wastes.
- No lock for wheels

Model 7:

Pros:

- Simple and Light weight
- Easier to keep medicines and sort out medicines for each patient as different partitions are provided for each room.
- Have both open and closed racks to keep drugs accordingly.
- Have facility to dispose clinical wastes.
- Have open table to keep patient charts / records.
- Have locks for wheels.

Possible design using convergent thinking

Fact1) it must have to carry all the place with item/medicine

Fact2) medicine carry racks must be there

Fact3) It must be light weight and easy to carry

Fact4) it must have a handle to pull

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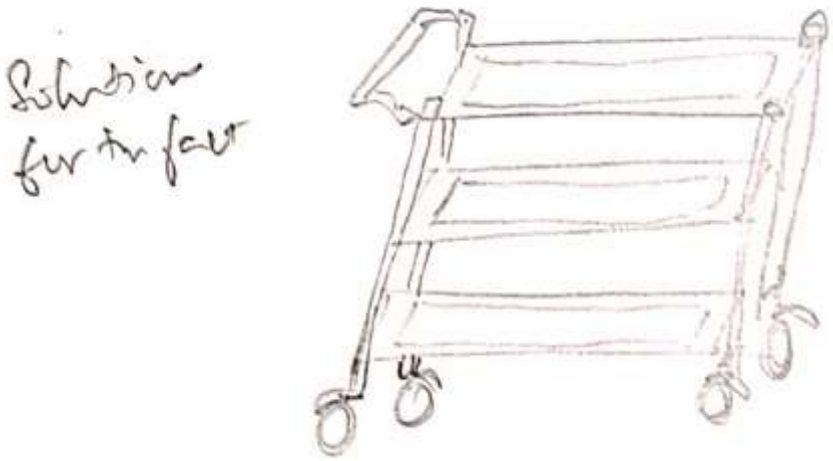


Possible design using divergent thinking

In divergent thinking we are exploring new ideas to improve the design of a drug trolly, let us discuss more ideas by including the facts

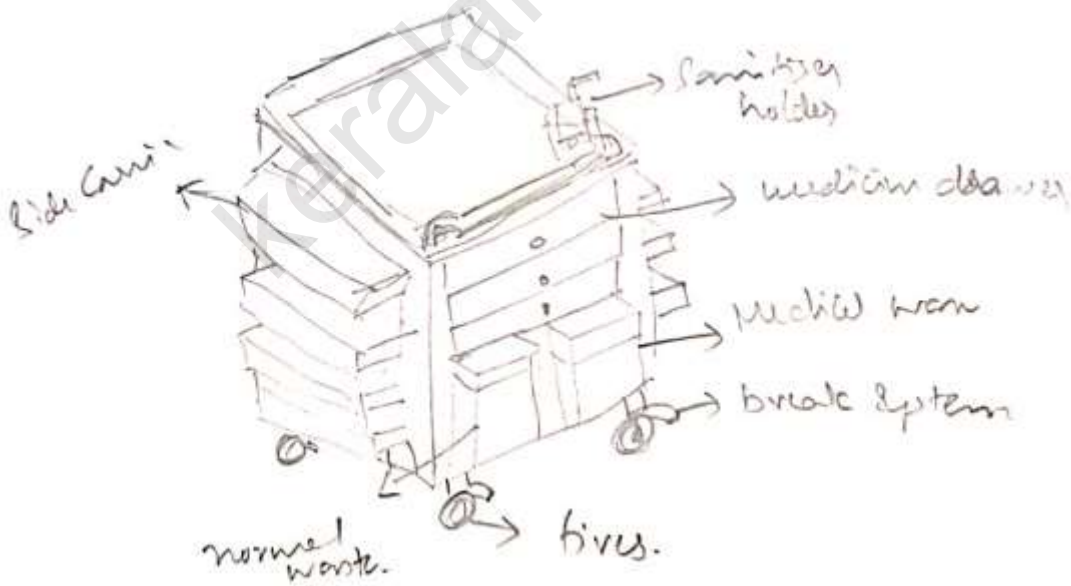
Idea1) instead trays we can use drawers to keep the medicine safe

Idea2) Additional racks can be added in the sides of the trolly for more compartments

Idea3) Add an extra section for hand sanitiser

Idea4) waste bins can be placed for both medical and normal waste

Idea5) can add breaks at the wheels to keep it in same position



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