THINK!
DESIGN

D'source Project

Open Design School

MoE's Innovation Cell

Case Study with CI

Design Thinking & Innovation Case Study

Section: C5, Week 5

Design Thinking & Innovation (DT&I)

Section: C5.0

Week 5

Design Thinking & Innovation (DT&I)

Prof. Ravi Poovaiah
IDC School of Design, IIT Bombay

DT&I Case Study

C5 Case Study with CI

Module C5:

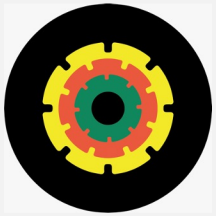
C5.1

Case Study Smart Device for Bedrooms

DT&I Case Study Content:

DT&I Process
(20%)

> Research
> Analysis
> Ideation
> Prototyping
> Feedback
> Implementation



DT&I Tools
(20%)

> Brain-Storming
> Mind-Mapping
> Contextual Inquiry
> Interviews
> Affinities
> Spatial Mappings

DT&I Project
(50%)

> Secondary Research
> Primary Research
> Use of Tools
> Prototyping
> Validation

DT&I Case Study
(10%)

> Case Study Project IxD Project – **Smart Device for Bedroom**

Mentor for Case Study Example:
Prof. Anirudha Joshi
Students:
Anuj Ambhore, Laksh Rajpal,
Manu Krishnan, Samarth Dhanuka

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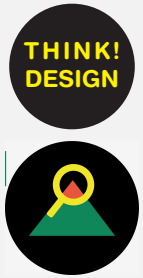
//What is Den-Z?

A system that includes a wall mounted touch screen switchboard that includes controls to lights, fans, Air Conditioner, windows and curtains and several other electrical appliances including novelty devices like speakers, television sets etc.

The system is integrated with a mobile phone application which allows tracking usage and control of the system via Wi-fi and Bluetooth. The system would allow users to personalize their preferences and settings. The system would be integrated with AI and sensors that suggest optimizations to their existing/current set up.

//Initial Brief

Design a bedroom automation system controller that can be retrofitted in a typical Indian middle class bedroom. The controller needs to be wall-mounted and will look similar to a fan regulator.



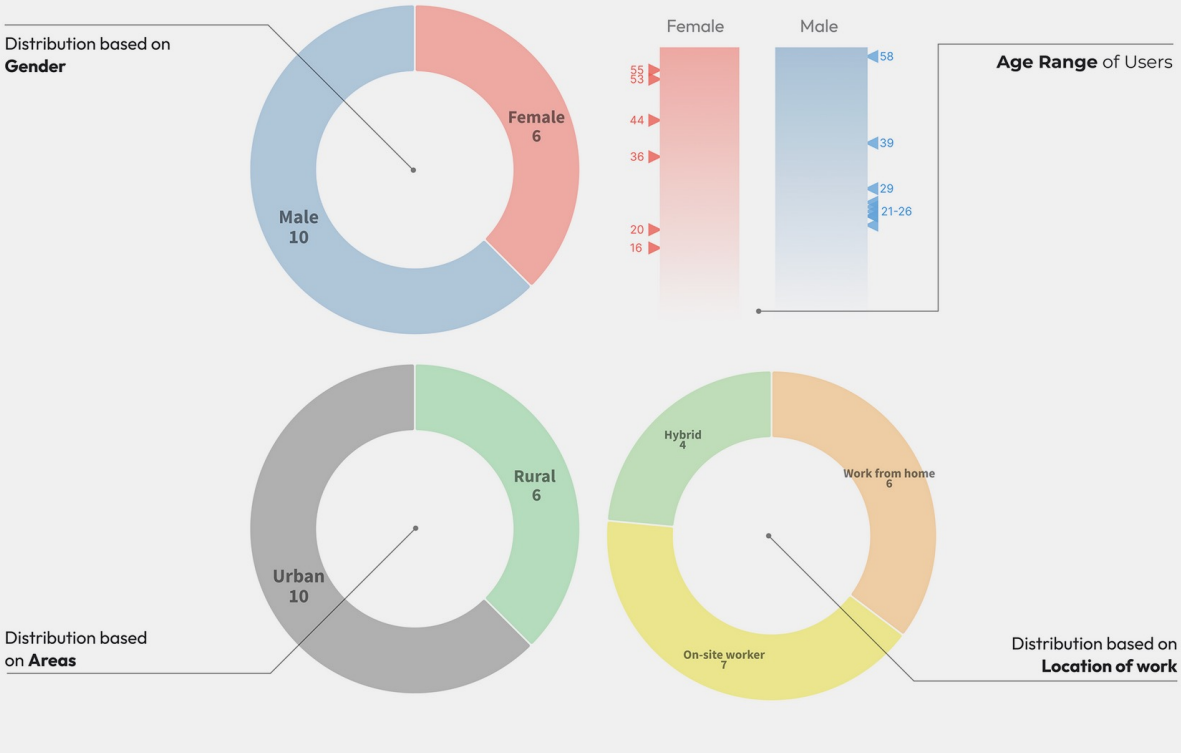
//Process

Week 1	Week 2	Week 3
User Research & Understanding	Narrowing Focus	Design & Evaluation
Contextual Inquiry	Affinity Mapping	Information Architecture
Interpretation	Revising Design Brief	Wireframing & Prototyping
Work Models	Personas & Scenarios	User Testing
	UX Goals & User Flows	Visual Identity
		Revised Design

//Contextual Inquiry

To gain deeper insights into the challenges users encounter, we conducted in-home interviews with a sample of **16 individuals**. These interviews allowed us to not only understand their daily routines and how they utilize their living spaces but also to empathize with their unique problems and needs more effectively. The demographics of the users vary as follows:

Demographics



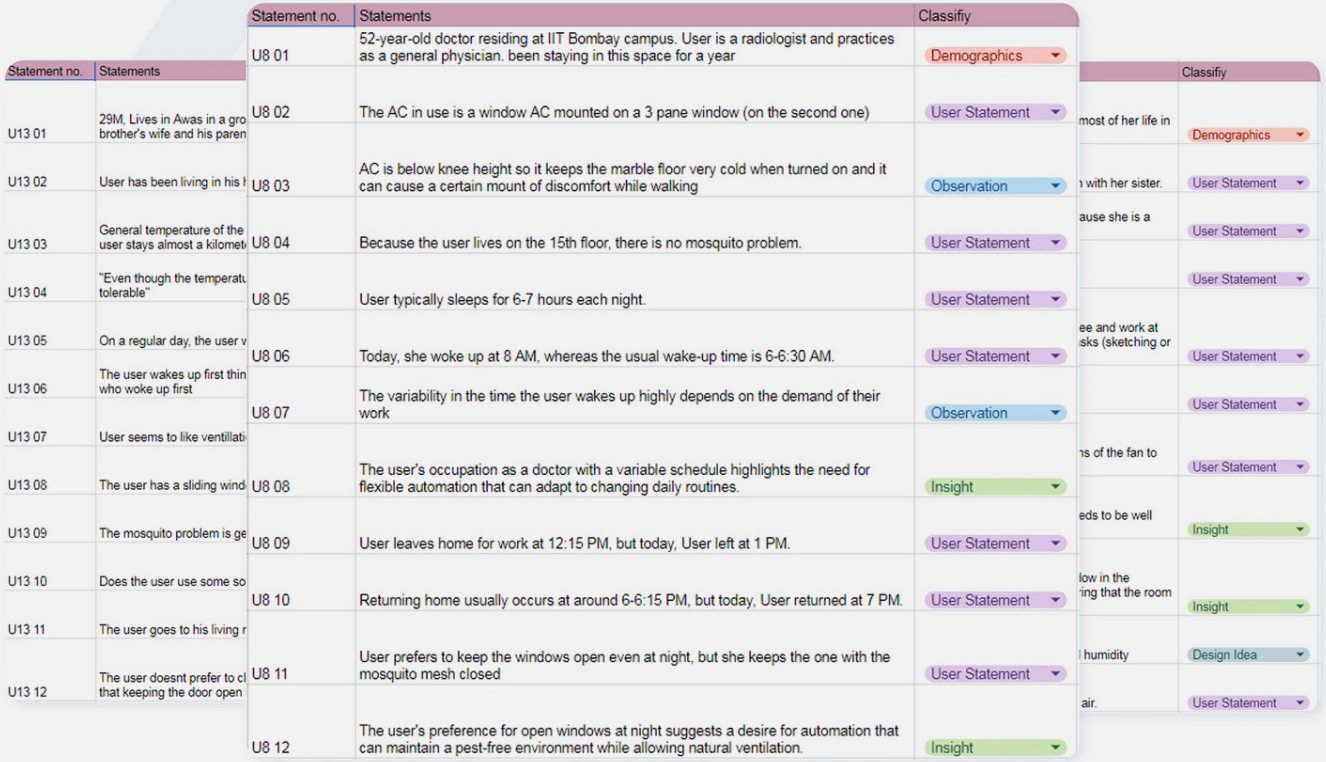
//Initial Focus for the Contextual Inquiries

In the study, we gathered insights into **user's daily living habits and experiences** within their homes. We focused on their bedroom usage, residence duration, routines, window interaction, temperature regulation methods, strategies for coping with summer heat and humidity, and electricity consumption. This exploration provided valuable data for enhancing living space design and energy efficiency while improving overall comfort and quality of life.

Key Points of the Inquiry

- How much time do they spend in their bedroom?
- How long have they been living in this house/bedroom?
- What is their routine like?
- How do people interact with their windows?
- How do they regulate temperatures?
- How do two people sharing the same room choose a comfortable temperature?
- How do they manage extreme summer heat or extreme humidity?
- What is their electricity bill like?

Contextual Inquiry - Interpretations



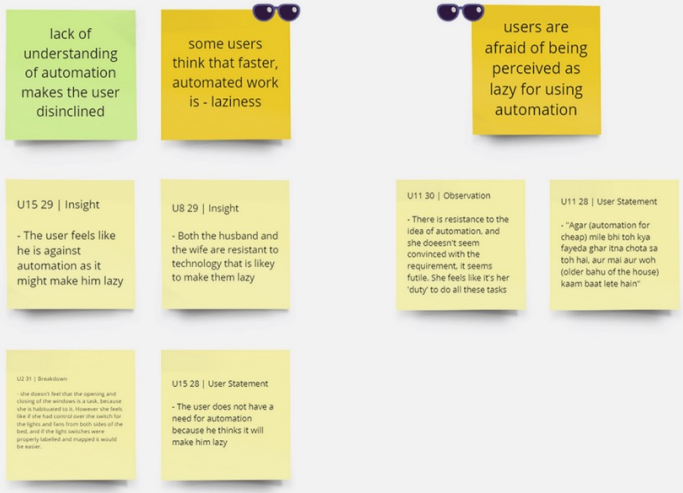
Statement no.	Statements	Classifiy
U8 01	52-year-old doctor residing at IIT Bombay campus. User is a radiologist and practices as a general physician. been staying in this space for a year	Demographics
U8 02	The AC in use is a window AC mounted on a 3 pane window (on the second one)	User Statement
U8 03	AC is below knee height so it keeps the marble floor very cold when turned on and it can cause a certain mount of discomfort while walking	Observation
U8 04	Because the user lives on the 15th floor, there is no mosquito problem.	User Statement
U8 05	User typically sleeps for 6-7 hours each night.	User Statement
U8 06	Today, she woke up at 8 AM, whereas the usual wake-up time is 6-6:30 AM.	User Statement
U8 07	The variability in the time the user wakes up highly depends on the demand of their work	Observation
U8 08	The user's occupation as a doctor with a variable schedule highlights the need for flexible automation that can adapt to changing daily routines.	Insight
U8 09	User leaves home for work at 12:15 PM, but today, User left at 1 PM.	User Statement
U8 10	Returning home usually occurs at around 6-6:15 PM, but today, User returned at 7 PM.	User Statement
U8 11	User prefers to keep the windows open even at night, but she keeps the one with the mosquito mesh closed	User Statement
U8 12	The user's preference for open windows at night suggests a desire for automation that can maintain a pest-free environment while allowing natural ventilation.	Insight

Contextual Inquiry – Summary on Cards

Contextual Inquiry – Sorted Cards

Some users believe that faster, automated work **is 'laziness'** or **will make them lazy**, while other users are afraid of being **perceived** as lazy for using automation

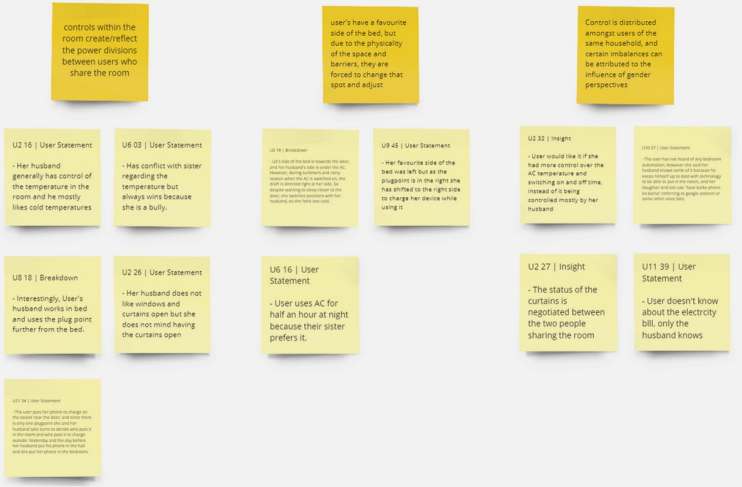
users may or may not exhibit cost consciousness, but ignore it when it comes to usage habits



Contextual Inquiry – Sorted Cards

users negotiate needs vs preferences and exhibit divisions in control/power (power distance) which may also be influenced by gender perspectives

For users with medical conditions, or their dependants, bedrooms should be spaces that prioritize protection, mobility, accessibility, cleanliness, and rest. And allow for control over elements with ease to facilitate the same, along with trackability



Contextual Inquiry – Key Inferences

Social and **cultural factors** also tend to dictate the interaction of different users with several elements of their room

For users with medical conditions, or their dependants, bedrooms should be spaces that **prioritize protection, mobility, accessibility, cleanliness, and rest**. And allow for control over elements with ease to facilitate the same, along with **trackability**

The physical layout and **placement of elements** in the room limits the user and controls/ **lengthens their movements**

Some users are passive when it comes to manual daily actions (like opening windows for ventilation) while **some of them like to take up that responsibility** and manage actions in their room

Users may or may not exhibit **cost consciousness** but ignore it when it comes to usage habits

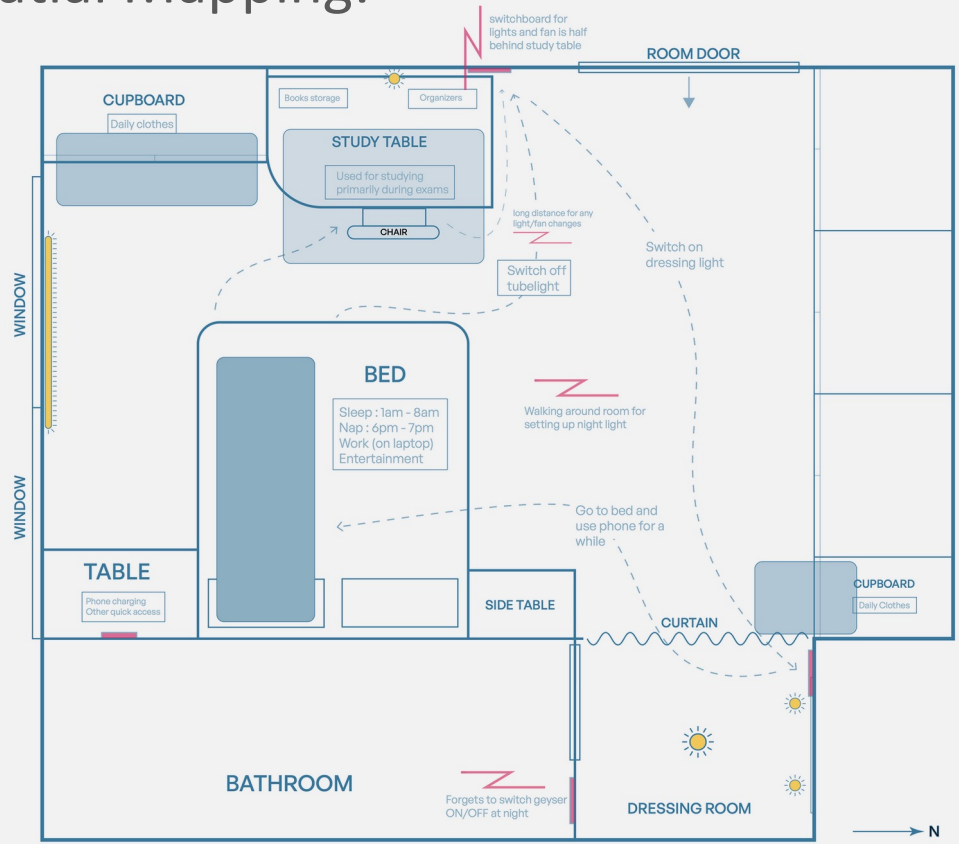
Safety concerns and convenience drive the users interaction with their windows

Some users believe that faster, automated work is **'laziness' or will make them lazy**, while other users are afraid of being perceived as lazy for using automation

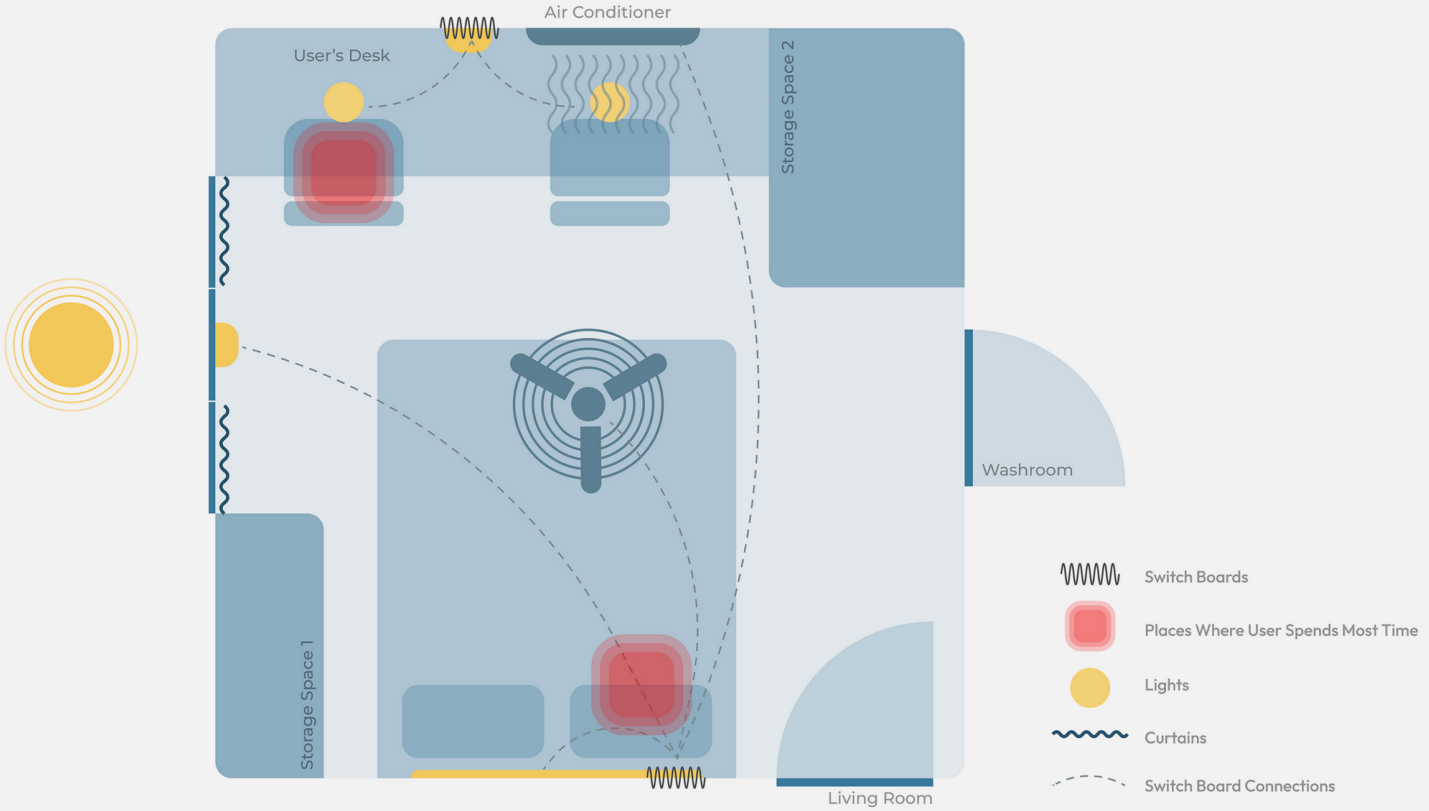
Users negotiate **needs vs preferences** and exhibit divisions in control/power (power distance) which may also be influenced by gender perspectives

Quantities of control (such as degree of temperature or intensity of light) are **less important** to the user than quantified expenditure

Artifact Spatial Mapping:



Artifact Spatial Mapping:



Contextual Inquiry – Change in focus

Initial Focus

How much time do you spend in your bedroom? How long have they been living in this house/bedroom?
What is your routine like?
How do people interact with their windows?
How do they regulate temperatures?
How do two people sharing the same room choose a comfortable temperature?
How do you manage the summer heat in Bombay or the extreme humidity?
What is your electricity bill like?

Evolved Focus

How would people be **onboarded** to this system?
How will automation be able to cater to **variable demographics**?
How do we fit automation in the **user's habits**?
What frame of reference for 'time' should be used in automation?
How many sensors or **newer forms of technologies** need to be involved in automation?
How can we provide **remote access** to users?
How do we make the system **scalable**?

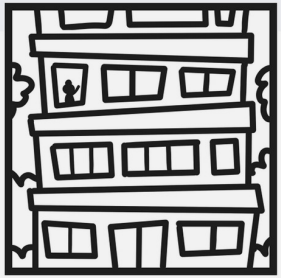
//Revised Design Brief

How might we design an equitable bedroom automation system that is accessible and affordable for Indian families with upper to lower middle class income levels, which helps them control appliances and elements in their room easily, reduce effort for them and save time, while prioritising features such as safety, comfort and trackability - that they can incorporate into their routines easily.

//Problem Case Scenarios

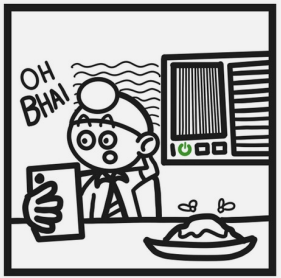
13 year old Talwinder's parents are disappointed in him. He is often seen as a spoiled brat.

Talwinder belongs to a middle class family and lives on the 2nd floor of B wing in Shanti Society.

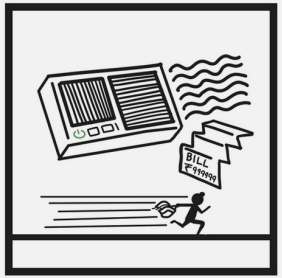


Every morning at six, Talwinder's alarm gives him a mini heart attack, sounding like a machine gun. This is his "strategy" to prepare for what he sees as a daily battle with his teachers at school.

After school at 1 pm, Talwinder goes to his room with his lunch, where he eats while watching gaming streams on his tablet with the AC on. He often gets engrossed, extending his lunchtime making his food stale.



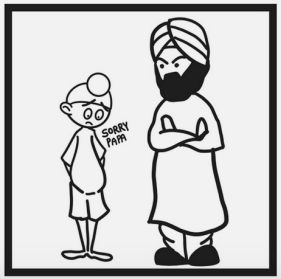
Talwinder's eating habits make him late for his 3:30 pm tuition classes, and he frequently forgets to turn off the AC. This oversight frustrates his father due to rising electricity bills.



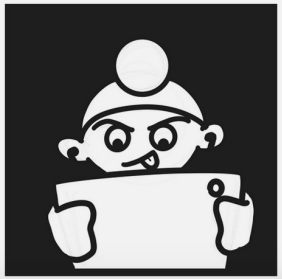
Returning from tuition at 6 pm, Talwinder switches on the fan, throws his bag on the bed, and briefly rests for five minutes. During this time, his friends from the society compound shout and invite him to play football, he opens the windows to answer to them and leaves the windows open and fan running before joining them.

After playing, Talwinder showers, and comes back to his room to change in the midst of all the mosquitos that have entered because of the open window.

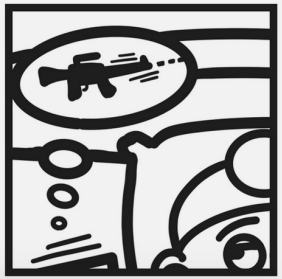
Dinner follows a similar routine, with Talwinder returning to his room with the AC running. After eating, he reluctantly leaves his dirty dishes in the kitchen, enduring the regular half an hour of parental scolding.



Then, he spends at least two hours playing PUBG in the darkness of his room and falls asleep with the tablet on his chest.



The next morning is followed by similar machine gun noises.



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//Key Problems the Design Must Solve

Users might face difficulties **onboarding** due to **lack of knowledge and awareness**.

Users struggle with controlling appliances because of **"tough-to-access" switchboards**.

Address users that are **reluctant to take responsibility** of opening and shutting doors, windows or curtains of their room and still wish to ensure ventilation.

Find effective ways to **minimize dust** entry while considering factors like the use of mosquito meshes and window opening habits.

Design systems to **prioritize protection, mobility, accessibility, cleanliness, and rest** for users with medical conditions.

Address the multi-step process of **dealing with mosquitoes**.

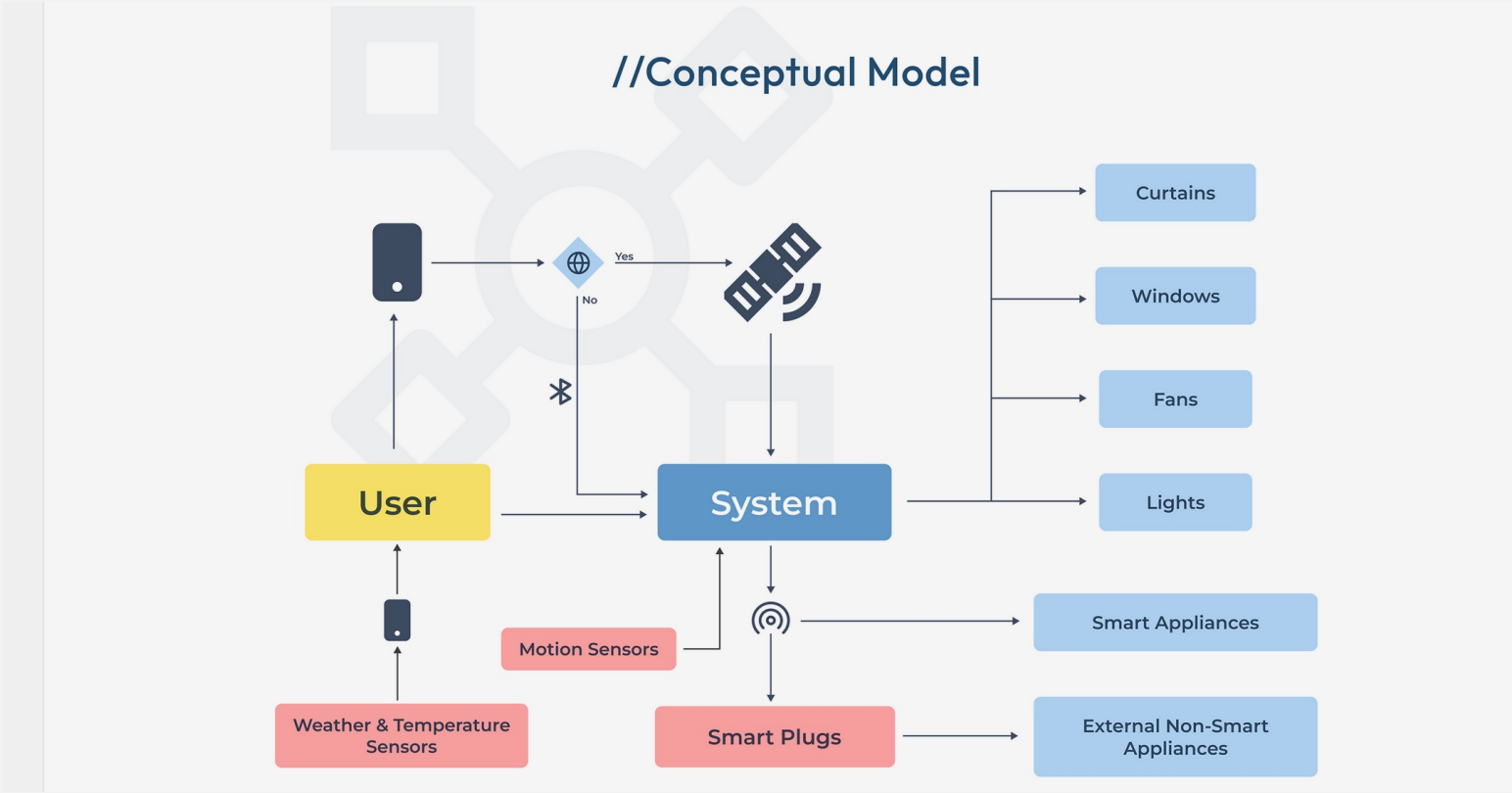
Balance privacy preferences with the need for natural light and ventilation.

Help the users **deal with emergencies or urgencies** related to their spaces.

Minimize interference and disturbance caused by noise, light, or movement.

Help the users keep a **track of their energy consumption**.

Conceptual Model



Persona

Name: Kshitij Agarwal
Age: 24
Occupation: Data Analyst
Location: Bangalore (Originally from Delhi)

Lifestyle Overview:
Kshitij lives in a well-furnished 1 BHK apartment on the 4th floor, where he enjoys the company of his pet cat. His work follows a hybrid schedule, with 3 days offline and 3 days as WFH. Sundays occasionally turn into workdays. He is committed to staying active, evident in his morning walks and regular gym sessions. These activities help him maintain physical and mental well-being, but they also necessitate a responsive living environment that accommodates his fitness regimen.

Motivation:
- Convenience and Comfort
- Efficiency in Work
- Pet Care
- Battery Health
- Natural Light

Pains:
- Loneliness
- Forgetfulness
- Privacy and Security
- Mosquitoes
- Unpleasant Smells

Name: Satyajeet Murthy
Age: 47
Occupation: Manager
Location: Powai, Mumbai

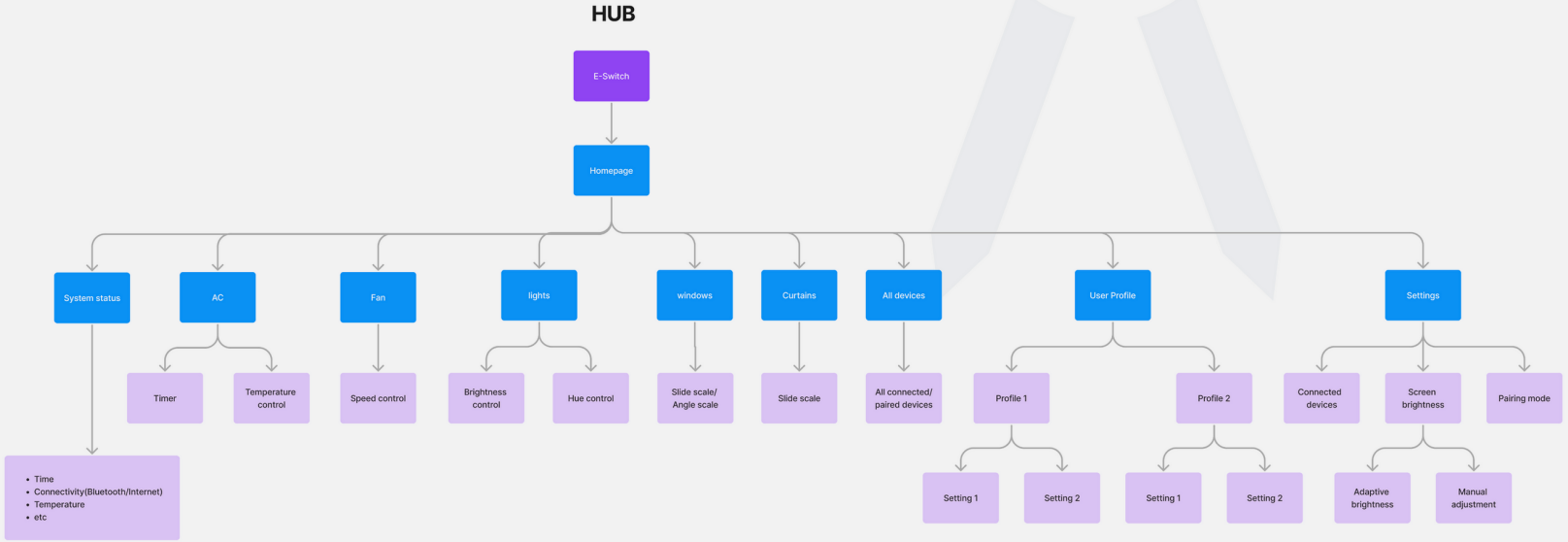
Name: Talwinder
Age: 13
Occupation: Student
Location: Dadar, Mumbai

Name: Priya
Age: 47
Occupation: Home-maker
Location: Powai, Mumbai

THINK!
DESIGN

//Information Architecture

We've methodically organized user flows and information flow hierarchies for both the touchscreen switchboard and the mobile app.



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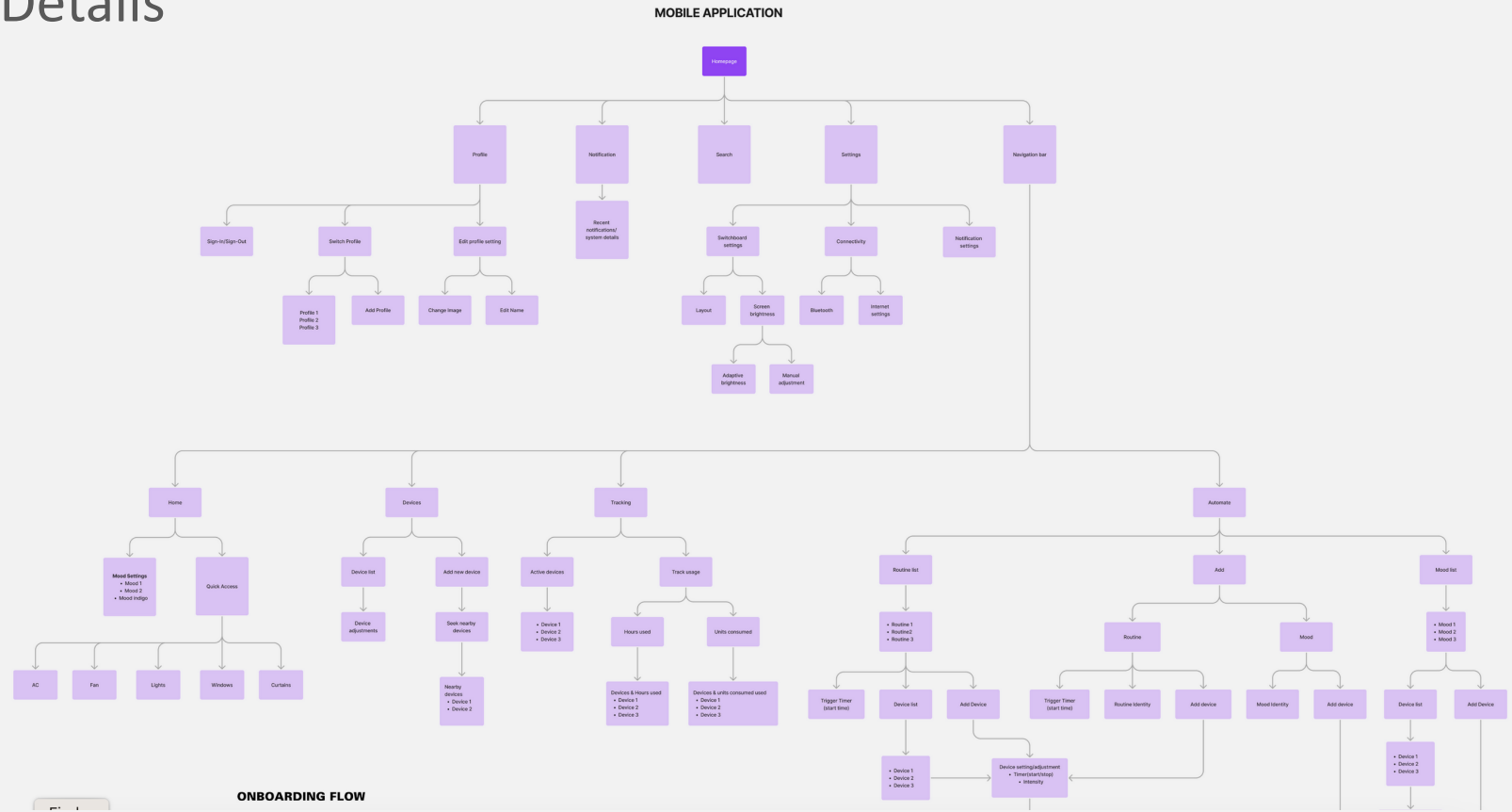
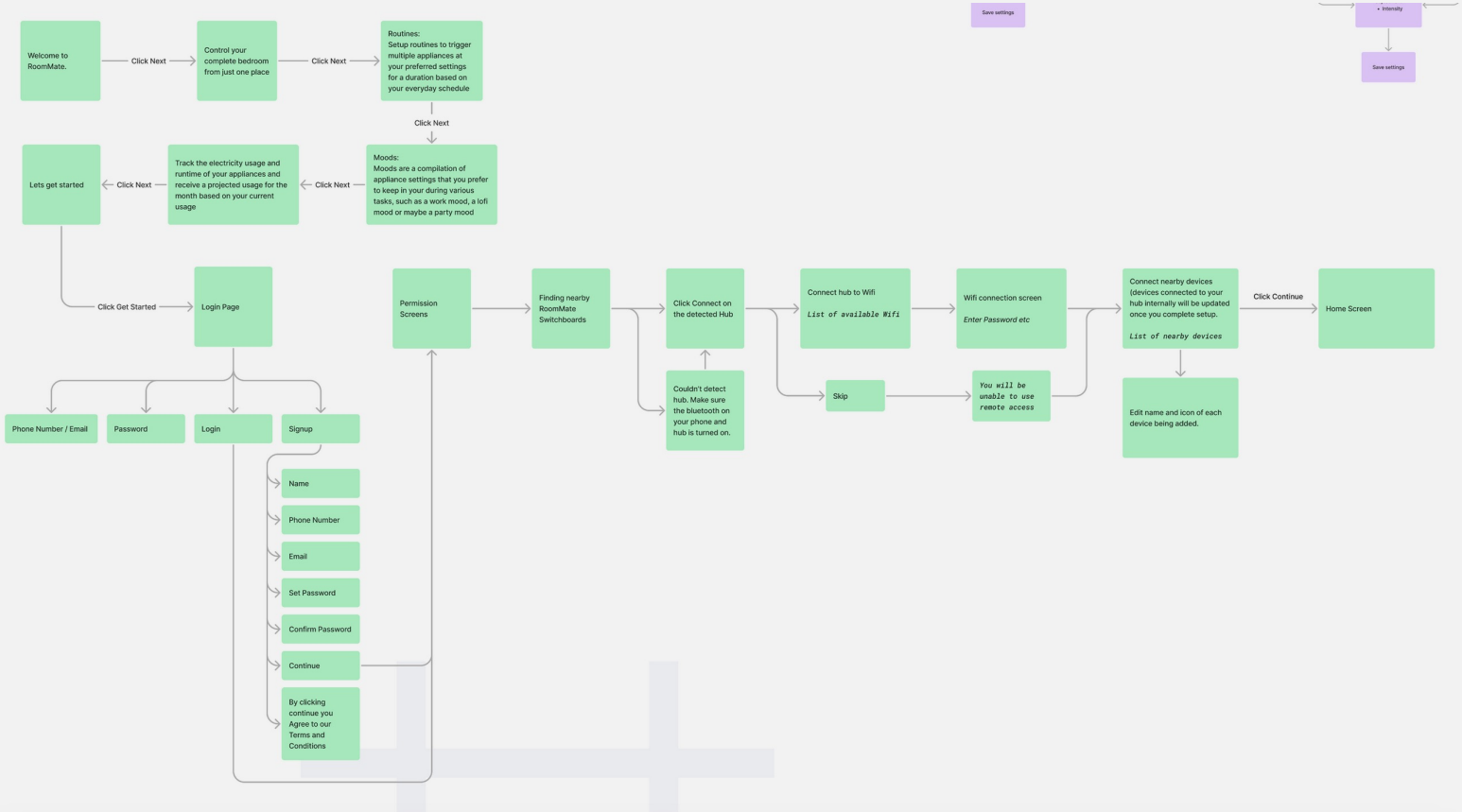

MOBILE APPLICATION
Homepage
Profile
Notification
Search
Settings
Navigation bar
Sign-in/Sign-Out
Switch Profile
Edit profile setting
Recent notifications/ system details
Switchboard settings
Connectivity
Notification settings
Profile 1
Profile 2
Profile 3
Add Profile
Change Image
Edit Name
Layout
Screen brightness
Bluetooth
Internet settings
Adaptive brightness
Manual adjustment
Home
Devices
Tracking
Automato
Mood Settings
• Mood 1
• Mood 2
• Mood indigo
Quick Access
Device list
Add new device
Active devices
Track usage
Routine list
Add
Mood list
Device adjustments
Seek nearby devices
Hours used
Units consumed
Routine
Mood
AC
Fan
Lights
Windows
Curtains
Nearby devices
• Device 1
• Device 2
Devices & Hours used
• Device 1
• Device 2
• Device 3
Devices & units consumed used
• Device 1
• Device 2
• Device 3
• Routine 1
• Routine2
• Routine 3
Trigger Timer (start time)
Device list
Add Device
Routine Identity
Add device
Mood Identity
Add device
• Mood 1
• Mood 2
• Mood 3
Device list
Add Device
• Device 1
• Device 2
• Device 3
Device setting/adjustment
• Timer(start/stop)
• Intensity
ONBOARDING FLOW

THINK!
DESIGN

Details



THINK!
DESIGN

Prototyping

THINK!
DESIGN

//Prototype & Evaluation Tasks

We've created wireframed prototypes for four distinct tasks, arranged in ascending order of complexity. This approach allows us to effectively assess our app's performance and usability. The Tasks are as follows:

01

Turn on the fan.
Set the fan speed to 3.

02

Automate a routine for your working days (Monday to friday), name it “New Morning” where you use the AC from 12:30 am to 3:30 am, get up at 6:30 am and open the curtains letting in natural light, playing your default alarm at the same time.

03

Set up a mood for when you have to work from home: The fan should run at the speed of 1, the AC should be at 22 degrees and the curtains should be wide open.

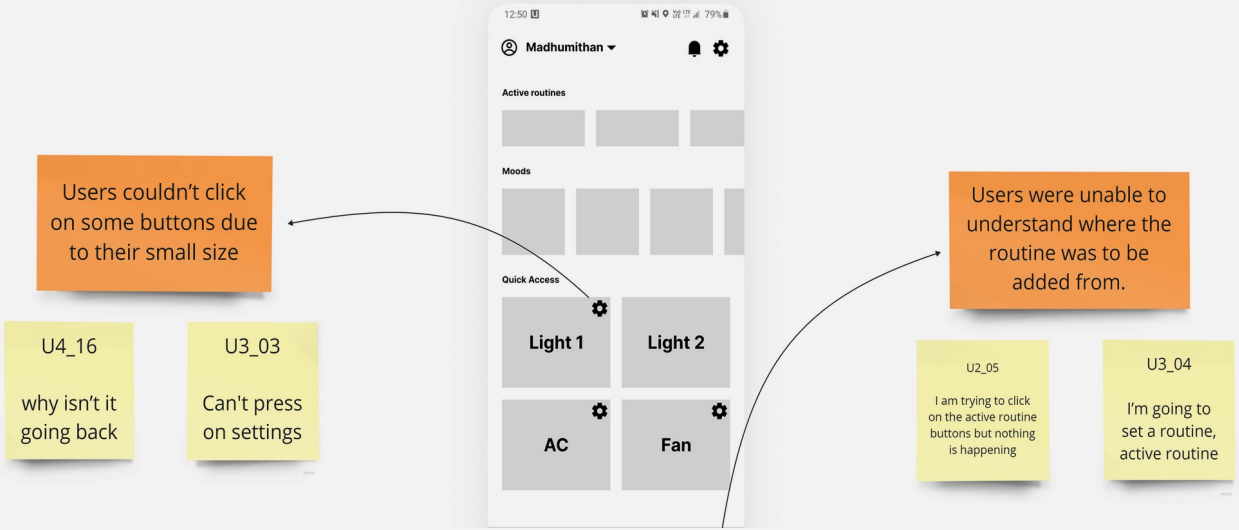
04

Find out how many units of electricity you have consumed in this month and for how long your light has been running today.

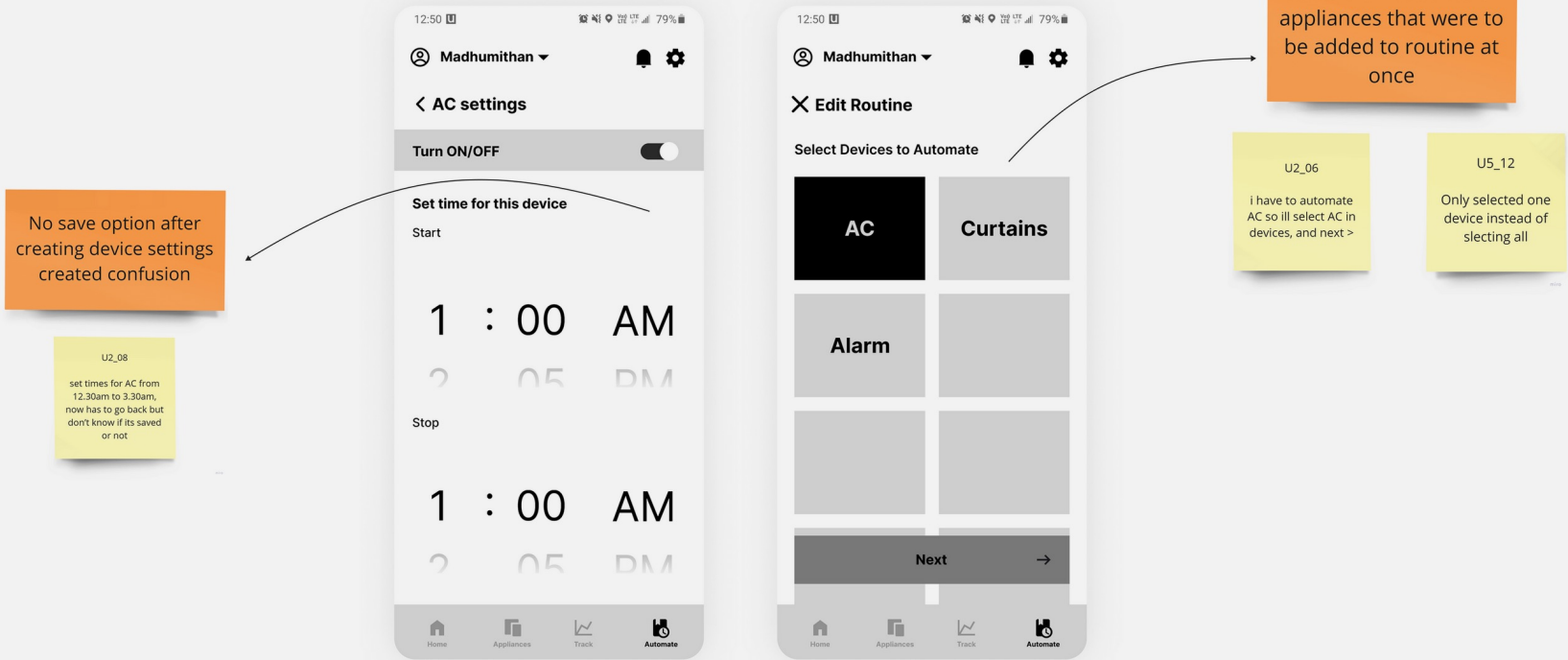
Feedback

Think Aloud Protocol

We performed think-aloud protocol testing with our wireframed prototype, and the findings have revealed several issues that warrant further attention and elaboration.

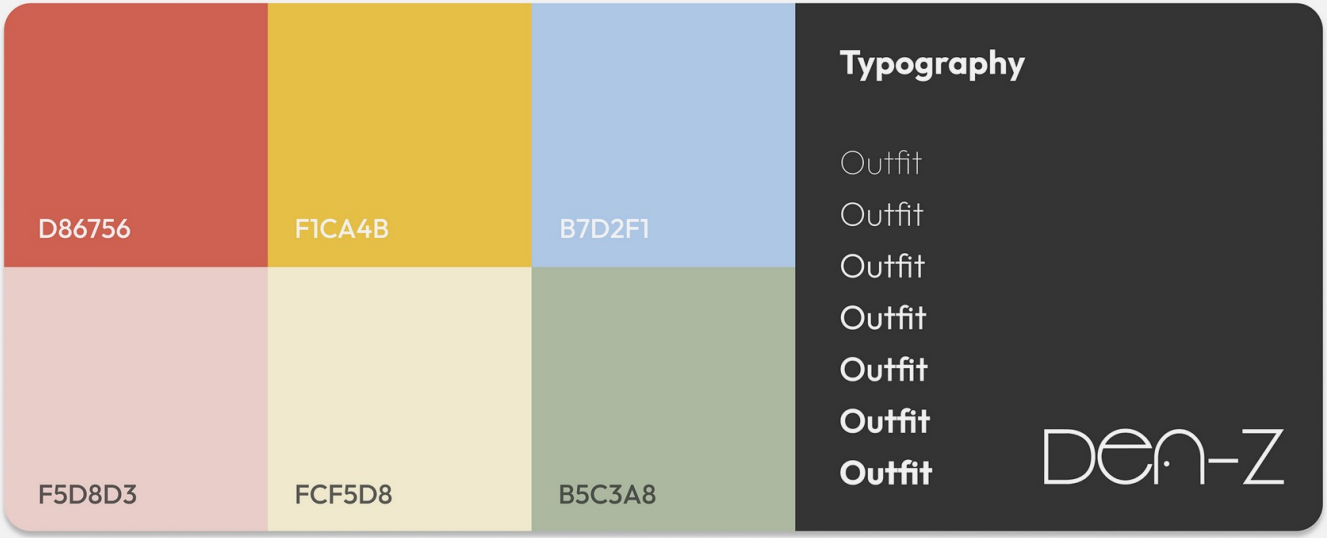


Interface development



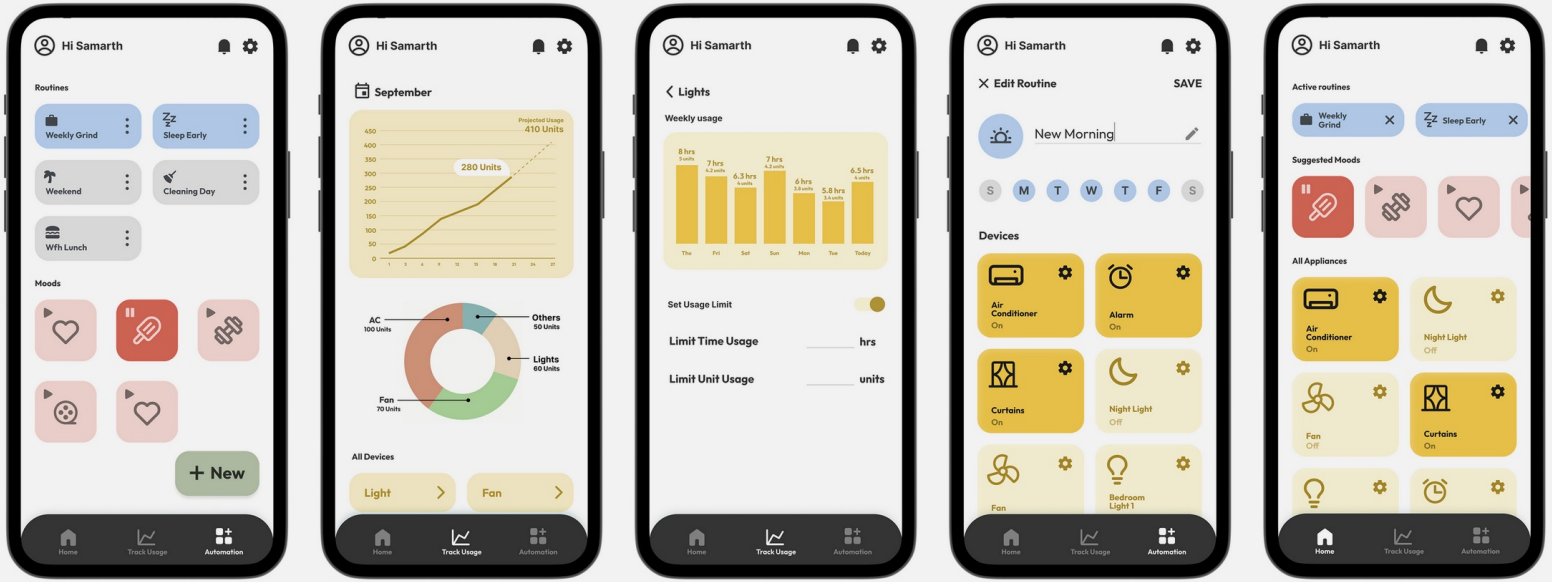
THINK!
DESIGN

//Visual Identity



Interface details

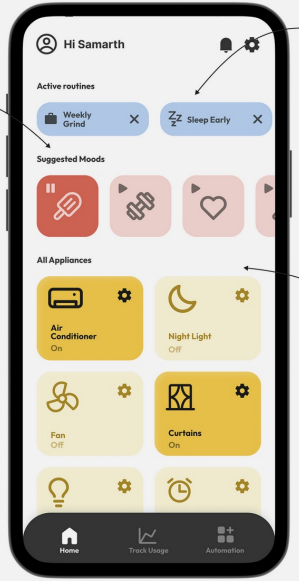
After undergoing numerous revisions and undergoing a thorough examination, the app has evolved into its current state, which is a result of careful refinement and improvement.



Interface Interactions

Law of Proximity

Similar buttons are grouped together for better understanding and differentiation.

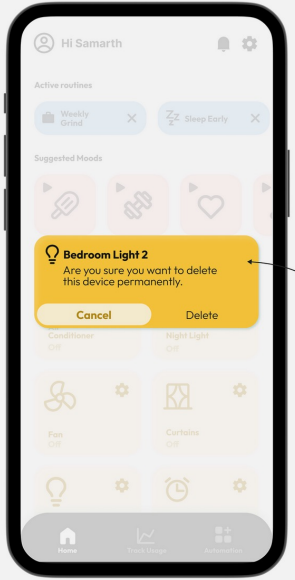


Hick's Law

Den-Z presents the most important and frequent actions on the home screen to ease decision making.

Fitts's Law

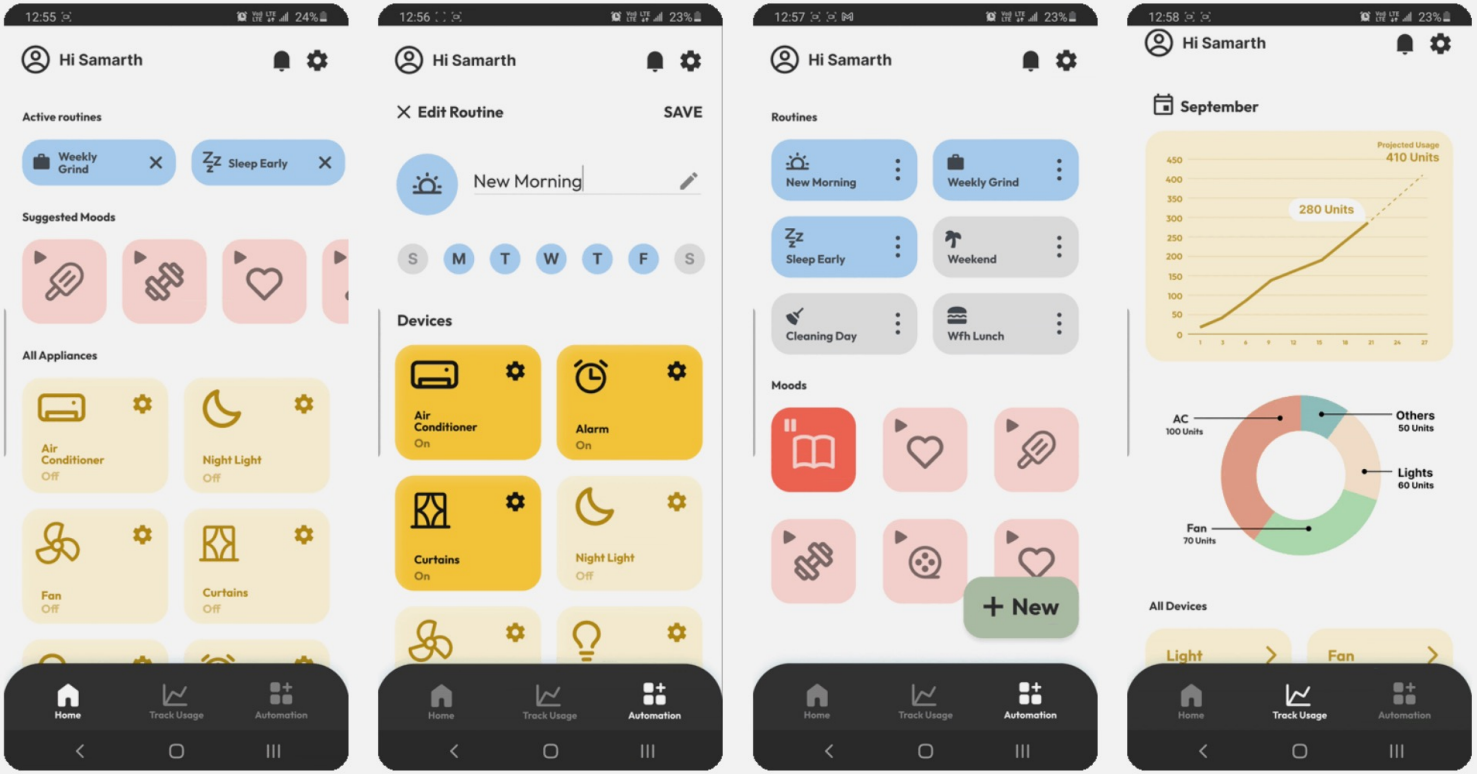
The buttons for appliances are large and within fingers' reach so that users can easily and quickly toggle them.



Murphy's Law

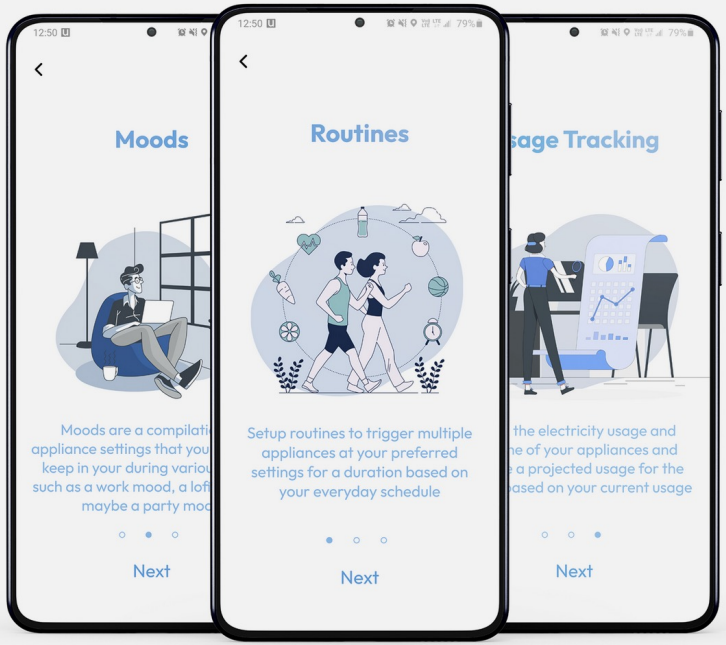
A confirmation message is shown to the user to before they delete a device. Tha cancel button is highlighted to

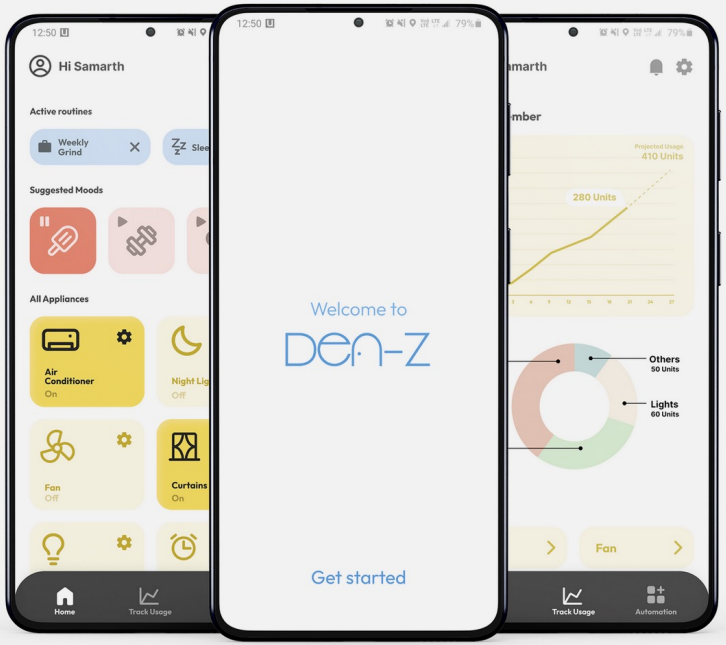
Interface micro interactions



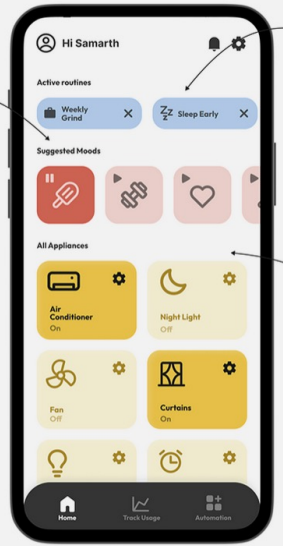
THINK!
DESIGN

Details





Final Solution



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THINK!
DESIGN

Thank You

Guided by
Prof. Anirudha Joshi

Laksh Rajpal Samarth Dhanuka
Manu Krishnan Anuj Ambhore

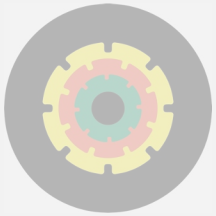
Thanks for Listening

DT&I Case Study
Section: C5
Week 5

DT&I Course – Week 5:

DT&I Process
(20%)

> Primary Research Part 1
> Interacting with Users

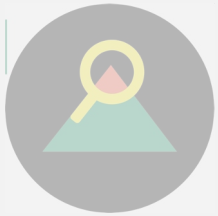


DT&I Tools
(20%)

> Contextual Inquiry

DT&I Project
(50%)

> Primary Research
> Contextual Inquiry



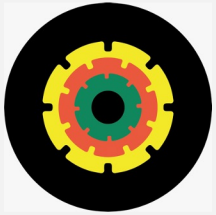
DT&I Case Study
(10%)

> Case Study Project IxD Project – Smart Device for Bedroom

DT&I Course – Week 6:

DT&I Process
(20%)

> Primary Research Part 2
> User Studies



DT&I Tools
(20%)

> Questionnaires
> Cue Cards for Talking to Experts

DT&I Project
(50%)

> Primary Research
> Questionnaires
> Talking to Experts

DT&I Case Study
(10%)

> Case Study Project - Lap Crate: A takeout box

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Supporting Organizations:

D’source

D’source Project

Open Design School

MoE’s Innovation Cell

D'source Project

Open Design School

MoE's Innovation Cell

Credits:

Mentor for Case Study Example:

Prof. Anirudha Joshi

Students:

Anuj Ambhore, Laksh Rajpal,
Manu Krishnan, Samarth Dhanuka

THINK! DESIGN

D'source Project

Open Design School

MoE's Innovation Cell

Credits:

Presented by:

Prof. Ravi Poovaiah

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DESIGN

D'source Project

Open Design School

MoE's Innovation Cell

Credits:

Camera & Editing:
Santosh Sonawane

Credits:

Think Design Animation:
Rajiv Sarkar

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Credits:

End Title Music:
C P Narayan

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Credits:

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IDC School of Design

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Case Study Project

Design Thinking & Innovation Case Study

Section: C5, Week 5

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Design Thinking & Innovation (DT&I)

Section: C5.0

Week 5

Design Thinking & Innovation (DT&I)

Prof. Ravi Poovaiah
IDC School of Design, IIT Bombay

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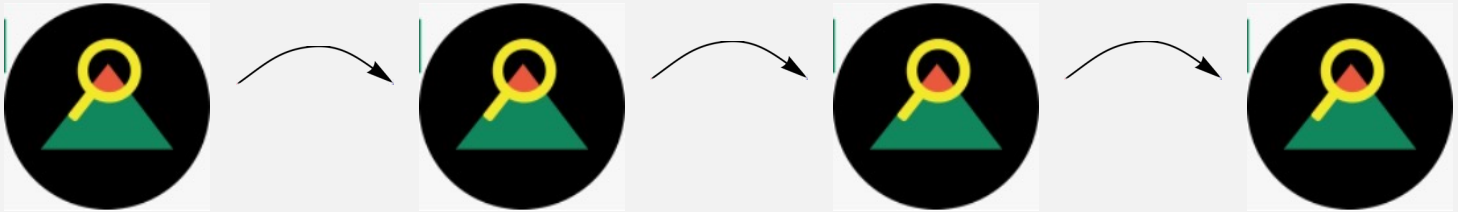
DT&I Project – Week 1-4:



Week 1

> Jellow Communicator (CD + IxD)

Week 2

> Smaran for the Elderly (PD + IxD)

Week 3

> Learning Culture through Stories (CD + IxD)

Week 4

> Solar Powered Pesticide Sprayer (PD)

DT&I Case Study

C5 Case Study Project 2

Module C5:

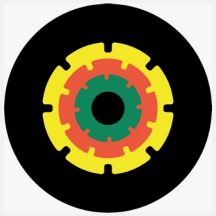
C5.2

Case Study - Alochana: News as Stories

DT&I Case Study Content:

DT&I Process
(20%)

> Research
> Analysis
> Ideation
> Prototyping
> Feedback
> Business Model



DT&I Tools
(20%)

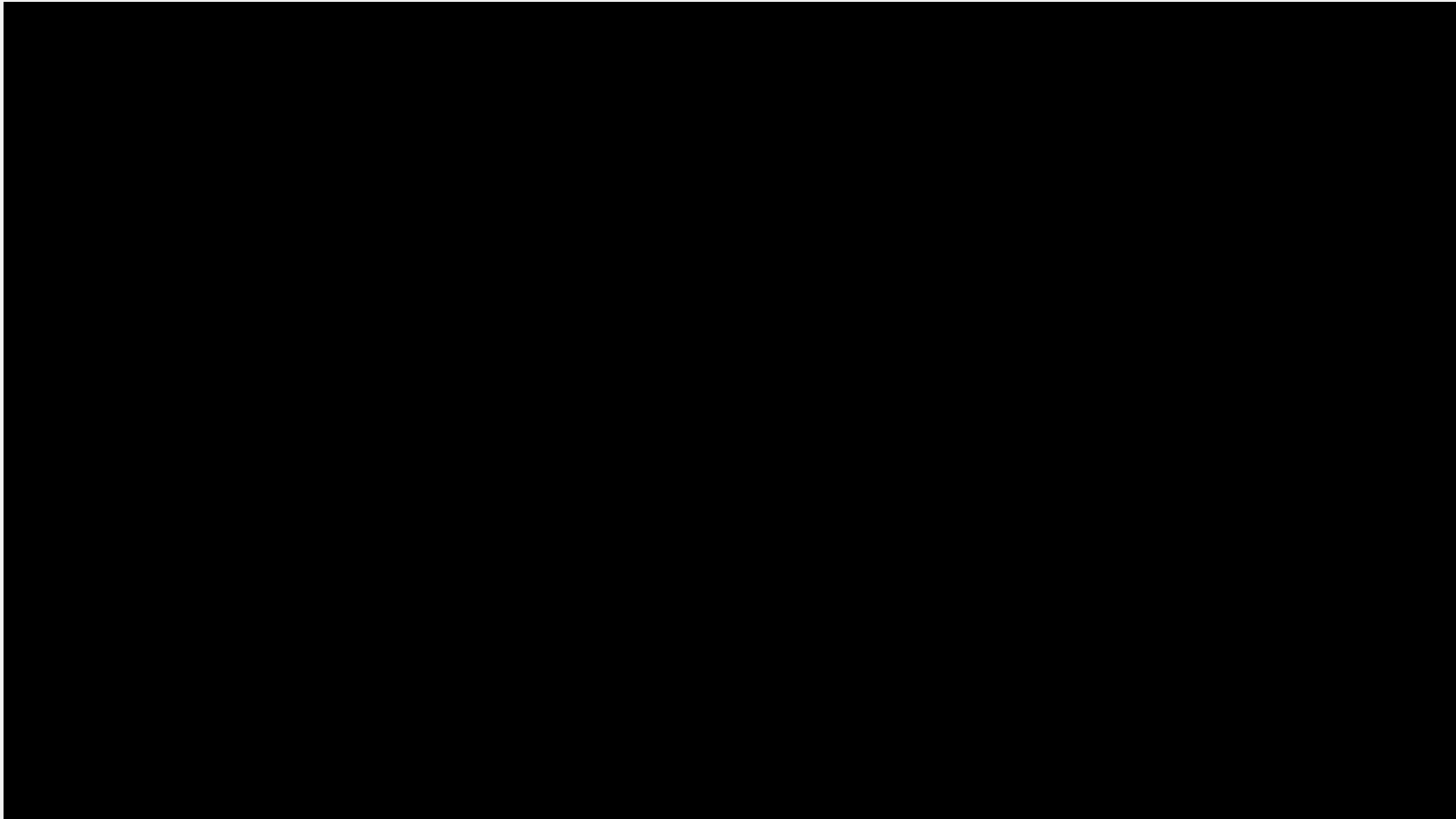
> Brain-Storming
> Mind-Mapping
> Contextual Inquiry
> Interviews
> Affinities
> Ideation

DT&I Project
(50%)

> Secondary Research
> Primary Research
> Use of Tools
> Prototyping
> Validation

DT&I Case Study
(10%)

> Case Study Project IxD Project – **Alochana: News as Stories**



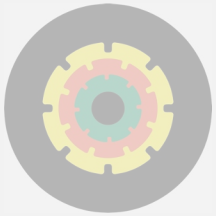
Thanks for Listening

DT&I Case Study
Section: C6
Week 6

DT&I Course – Week 5:

DT&I Process
(20%)

> Primary Research Part 1
> Interacting with Users

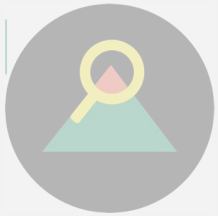


DT&I Tools
(20%)

> Contextual Inquiry

DT&I Project
(50%)

> Primary Research
> Contextual Inquiry



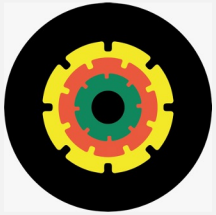
DT&I Case Study
(10%)

> Case Study Project IxD Project – Smart Device for Bedroom

DT&I Course – Week 6:

DT&I Process
(20%)

> Primary Research Part 2
> User Studies



DT&I Tools
(20%)

> Questionnaires
> Cue Cards for Talking to Experts

DT&I Project
(50%)

> Primary Research
> Questionnaires
> Talking to Experts

DT&I Case Study
(10%)

> Case Study Project - Lap Crate: A takeout box

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Supporting Organizations:

D’source

D’source Project

Open Design School

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MoE's Innovation Cell

Credits:

Mentors for Case Study Example:

Prof. Ravi Poovaiah

Prof. Avinash Shinde,

Dr. Ajanta Sen,

Dr. Guruprasad K. Rao

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Credits:

Students:

Arnesh Kundu
Mohak Gulati
Saumya Oberoi

আলোচনা

(Āloōcanō) Discussion-bo

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Credits:

Camera & Editing:
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Credits:

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Rajiv Sarkar

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Credits:

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