



FACULTY OF ENGINEERING AND TECHNOLOGY

BACHELOR OF TECHNOLOGY

COMPUTER SCIENCE AND ENGINEERING

ENTERPRISE PROGRAMMING

(303105152)

Design Thinking

2nd SEMESTER

LABORATORY MANUAL

CERTIFICATE

This is to certify ----- with Enrolment Number: -----has successfully complemented his laboratory experiments in the **Design Thinking (303105152)** from the department of **COMPUTER SCIENCE AND ENGINEERING** during the year **2024-2025**.



Date of submission	Staff in charge	HOD

INDEX

SNO	EXPERIMENT	PAGE NO	PERFORMA-- NCE DATE	ASSESME- NT DATE	MARK S OUT OF 10	SIGN
1	Introduction to Design Thinking: Concepts, Benefits, and Process					
2	Empathy mapping exercise: Have participants conduct interviews with potential users and create empathy maps to gain a deeper understanding of their Needs, wants, and pain points.					
3	Define the problem statement: Based on the empathy mapping exercise, have participants synthesize their findings and define a problem statement.					

4	Ideation session: Have participants generate as many ideas as possible to solve the problem statement. Encourage wild, unconventional, and Innovative ideas.					
5	Select one or more ideas and create a low-fidelity prototype to test their assumptions and validate their ideas.					
6	Have participants take test their prototype with potential users and gather feedback on what works, what doesn't work, and what could be improved					
7	Based on the feedback, have participants refined and iterate on their prototype to improve its usability, functionality and appeal.					
8	Participants test their prototype with potential users (in this case, college students using public transportation), gather feedback on what works, what					

	doesn't work, and what could be improved. The feedback will be used to refine the prototype further and improve its effectiveness.					
--	--	--	--	--	--	--

EXPERIMENT-1

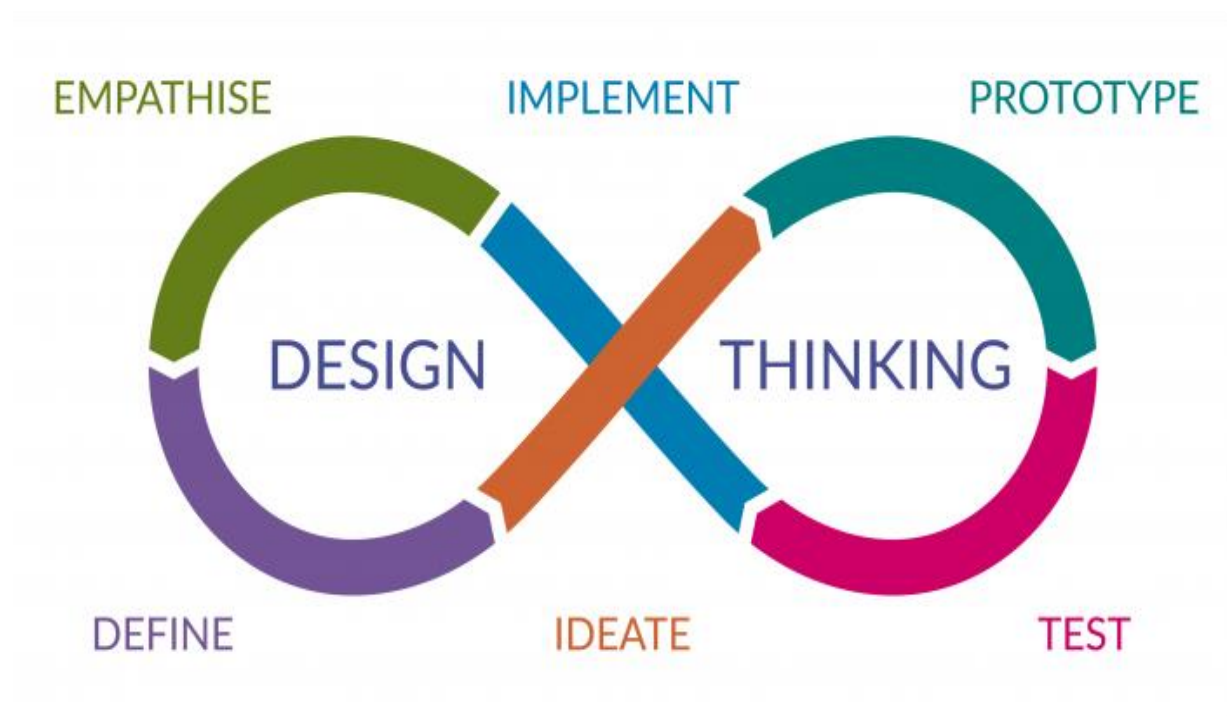
AIM: Introduction to Design Thinking: Concepts, Benefits, and Process

Definition :- Design thinking is a non-linear, iterative process that helps teams create innovative solutions to problems. It involves a series of stages that can be repeated or carried out simultaneously, and it's most useful for tackling ill-defined or unknown problems.

The five stages of design thinking are:

- **Empathize:** Understand the users' needs, thoughts, and feelings
- **Define:** Identify the problem and outline how it could be improved
- **Ideate:** Brainstorm creative ideas that are centered around the user
- **Prototype:** Build representations of potential solutions
- **Test:** Gather feedback from users to test the prototypes

Design Thinking Process



Design thinking can be beneficial for a number of reasons, including:

- **Innovation:** Design thinking encourages creativity and innovation, which can lead to competitive advantages
- **Alignment with business goals:** Design thinking helps teams create solutions that meet the needs of the business
- **Employee engagement:** Design thinking can lead to increased engagement and job satisfaction among team members
- **Time-to-market:** Design thinking can reduce the time spent on design and development
- **Cost savings:** Getting products to market faster can save money for the company
- **Customer retention:** Design thinking can increase user engagement and customer retention

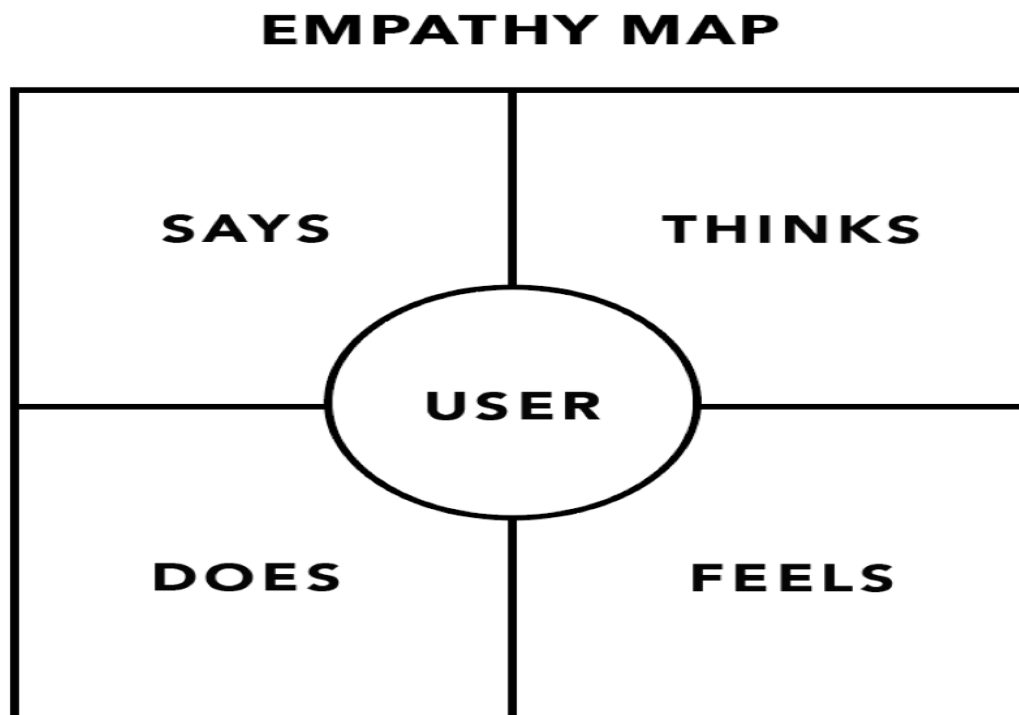
Design thinking can be used by almost any team in any business, and it's not just for designers.

EXPERIMENT-2

Empathy mapping exercise:

Have participants conduct interviews with potential users and create empathy maps to gain a deeper understanding of their Needs, wants, and pain points.

Definition - Traditional empathy maps are split into 4 quadrants (*Says*, *Thinks*, *Does*, and *Feels*), with the user or persona in the middle. Empathy maps provide a glance into who a user is as a whole and are not chronological or sequential.



Says

The *Says* quadrant contains what the user says out loud in an interview or some other usability study. Ideally, it contains verbatim and direct quotes from research.

"I am allegiant to Delta because I never have a bad experience."

"I want something reliable."

“I don’t understand what to do from here.”

Thinks

The **Thinks** quadrant captures what the user is thinking throughout the experience. Ask yourself (from the qualitative research gathered): what occupies the user’s thoughts? What matters to the user? It is possible to have the same content in both *Says* and *Thinks*. However, pay special attention to what users think, but may not be willing to vocalize. Try to understand why they are reluctant to share — are they unsure, self-conscious, polite, or afraid to tell others something?

“This is really annoying.”

“Am I dumb for not understanding this?”

Does

The **Does** quadrant encloses the actions the user takes. From the research, what does the user physically do? How does the user go about doing it?

Refreshes page several times.

Shops around to compare prices.

Feels

The **Feels** quadrant is the user’s emotional state, often represented as an adjective plus a short sentence for context. Ask yourself: what worries the user? What does the user get excited about? How does the user feel about the experience?

Impatient: pages load too slowly

Confused: too many contradictory prices

Worried: they are doing something wrong

Empathy maps are important in design thinking because they help designers understand their users and create user-centered designs:

- **Build empathy**

Empathy maps help designers understand their users' needs, pain points, and behaviors. This can help designers create more meaningful innovations.

- **Remove bias**

Empathy maps can help designers remove bias from their designs by capturing unfiltered perspectives from real quotes.

- **Synthesize knowledge**

Empathy maps can help teams synthesize their collective knowledge about their users. This can help teams develop a shared understanding of who the user is.

- **Identify opportunities**

Empathy maps can help designers identify potential areas for improvement and innovation.

- **Communicate findings**

Empathy maps can help designers communicate their user research findings to stakeholders.

- **Bridge the gap**

Empathy maps can help bridge the gap between designers and stakeholders.

- **Streamline the process**

Empathy maps can help streamline the process of identifying user struggles.

While empathy maps are a useful tool in design thinking, they can have some drawbacks, including:

- **Lack of context**

Empathy maps can focus on a single user's experience, which can lead to missing the bigger picture. Environmental factors can affect a user's thoughts and behaviours, which are difficult to capture in an empathy map.

- **Incomplete information**

If an empathy map is the only user research tool used, it can lead to gaps in understanding of the user experience. Empathy maps should be used with other research methods, like interviews, surveys, and usability testing.

- **Static nature**

Empathy maps are static representations, which can make it difficult to capture the dynamic nature of user thoughts and emotions. Empathy maps should be treated as living documents that are updated regularly.

EXPERIMENT-3

Define the problem statement:

Based on the empathy mapping exercise, have participants synthesize their findings and define a problem statement.

A problem statement is a short, clear explanation of an issue or challenge that sums up what you want to change. It helps you, team members, and other stakeholders to focus on the problem, why it's important, and who it impacts.

A good problem statement should create awareness and stimulate creative thinking. It should not identify a solution or create a bias toward a specific strategy.

Taking time to work on a problem statement is a great way to short-circuit the tendency to rush to solutions. It helps to make sure you're focusing on the right problem and have a well-informed understanding of the root causes. The process can also help you take a more proactive than reactive approach to problem-solving. This can help position you and your team to avoid getting stuck in constant fire-fighting mode. That way, you can take advantage of more growth opportunities.

The best time to create a problem statement is before you start thinking of solutions. If you catch yourself or your team rushing to the solution stage when you're first discussing a problem, hit the brakes. Go back and work on the statement of the problem to make sure everyone understands and agrees on what the real problem is.

Here are some common situations where writing problem statements might come in handy:

- Writing an executive summary for a project proposal or research project
- Collaborating on a cross-functional project with several team members
- Defining the customer issue that a proposed product or service aims to solve
- Using design thinking to improve user experience
- Tackling a problem that previous actions failed to solve

You can use problem statements for a variety of purposes. For an organization, it might be solving customer and employee issues. For the government, it could be improving public health. For individuals, it can mean enhancing their own personal well-being. Generally, problem statements can be used to:

- Identify opportunities for improvement

- Focus on the right problems or issues to launch more successful initiatives – a common challenge in leadership
- Help you communicate a problem to others who need to be involved in finding a solution
- Serve as the basis for developing an action plan or goals that need to be accomplished to help solve the problem
- Stimulate thinking outside the box and other types of creative brainstorming techniques

Example Problem Statement: The Destination Problem Statement

Example:

Leaders at Example Company want to increase net revenue for its premium product line of widgets by 5% for the next fiscal year.

This approach can be used to describe where an organization wants to be in the future. This type of problem statement is useful for launching initiatives to help an organization achieve its desired state.

Like creating SMART goals, you want to be as specific as possible. Note that the statement specifies “net revenue” instead of “gross revenue.” This will help keep options open for potential actions. It also makes it clear that merely increasing sales is not an acceptable solution if higher marketing costs offset the net gains.

Problem:

Leaders at Example Company aim to increase net revenue for its premium product line of widgets by 5% for the next fiscal year. However, the company currently lacks the necessary teams to tackle this objective effectively. To achieve this growth target, the company needs to expand its marketing and PR teams, as well as its product development teams, to prepare for scaling.

Background:

Example Company faces the challenge of generating a 5% increase in net revenue for its premium product line of widgets in the upcoming fiscal year. Currently, the company lacks the required workforce to drive this growth. Without adequate staff in the marketing, PR, and product development departments, the company's ability to effectively promote, position, and innovate its premium product line will be hindered. To achieve this kind of growth, it is essential that Example Company expands teams, enhances capabilities, and strategically taps into the existing pool of loyal customers.

Relevance:

Increasing net revenue for the premium product line is crucial for Example Company's overall business success. Failure to achieve the targeted growth rate can lead to missed revenue opportunities and stagnation in the market. By expanding the marketing and PR teams, Example Company can strengthen its brand presence, effectively communicate the value proposition of its premium product line, and attract new customers.

Additionally, expanding the product development teams will enable the company to introduce new features and innovations, further enticing existing and potential

customers. Therefore, addressing the workforce shortage and investing in the necessary resources are vital for achieving the revenue growth objective.

Objectives:

The primary objective of this project is to increase net revenue for Example Company's premium product line of widgets by 5% in the next fiscal year. The specific objectives include:

- Assessing the current workforce and identifying the gaps in the marketing, PR, and product development teams.
- Expanding the marketing and PR teams by hiring skilled professionals who can effectively promote the premium product line and engage with the target audience.
- Strengthening the product development teams by recruiting qualified individuals who can drive innovation, enhance product features, and meet customer demands.
- Developing a comprehensive marketing and PR strategy to effectively communicate the value proposition of the premium product line and attract new customers.
- Leveraging the existing base of loyal customers to increase repeat purchases, referrals, and brand advocacy.
- Allocating sufficient resources, both time and manpower, to support the expansion and scaling efforts required to achieve the ambitious revenue growth target.
- Monitoring and analyzing key performance indicators (KPIs) such as net revenue, customer acquisition, customer retention, and customer satisfaction to measure the success of the growth initiatives.
- Establishing a sustainable plan to maintain the increased revenue growth beyond the next fiscal year by implementing strategies for continuous improvement and adaptation to market dynamics.

EXPERIMENT-4

Ideation session:

Have participants generate as many ideas as possible to solve the problem statement. Encourage wild, unconventional, and Innovative ideas

Ideation is often the most exciting stage in a Design Thinking project, because during Ideation, the aim is to generate a large quantity of ideas that the team can then filter and cut down into the best, most practical or most innovative ones in order to inspire new and better design solutions and products.

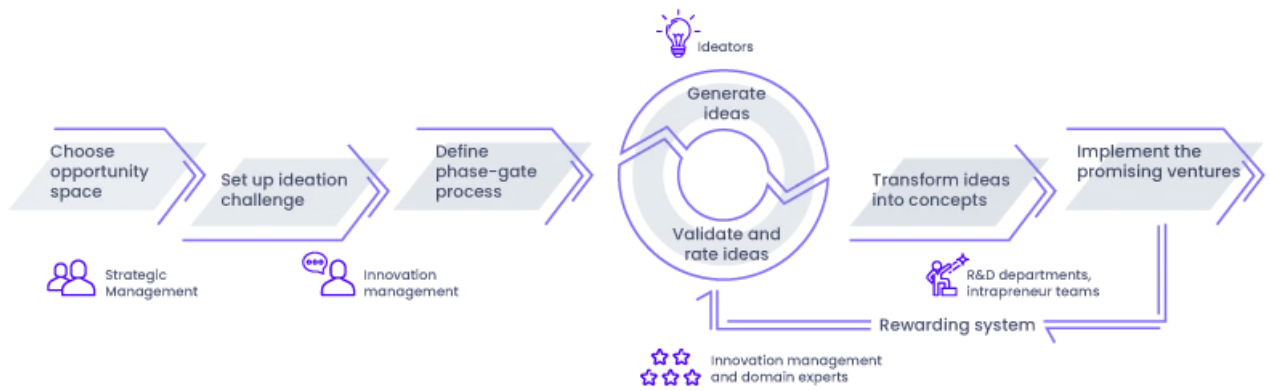
“Ideation is the mode of the design process in which you concentrate on idea generation. Mentally it represents a process of ‘going wide’ in terms of concepts and outcomes. Ideation provides both the fuel and also the source material for building prototypes and getting innovative solutions into the hands of your users.”

Ideation Will Help You:

- Ask the right questions and innovate with a strong focus on your users, their needs, and your insights about them.
- Step beyond the obvious solutions and therefore increase the innovation potential of your solution.
- Bring together perspectives and strengths of your team members.
- Uncover unexpected areas of innovation.
- Create volume and variety in your innovation options.
- Get obvious solutions out of your heads, and drive your team beyond them.

Ideation process steps

- A proper ideation process can help you to find answers to some very important questions within your innovation journey:
- Which strategic innovation fields are necessary for new products and services?
- How do I set up targeted ideation campaigns and who should contribute?
- How do I transform ideas into concepts, products, and solutions?
- **In the following, we present a simple process of an ideation challenge:**



PRACTICAL 5

Aim: Select one or more ideas and create a low-fidelity prototype to test their assumptions and validate their ideas.

Concept:

Rubber toys for kids are designed with the concept of safety, durability, and playfulness in mind. They often feature soft, flexible materials that are gentle on children's hands and mouths, while also being resilient to rough play. These toys can come in various shapes, sizes, and colors, catering to different age groups and interests. Additionally, they may incorporate educational elements or sensory stimulation to encourage learning and development during playtime.



Two large factor:

1. **Material Composition:** Rubber toys are typically made from natural or synthetic rubber materials, which provide unique properties such as durability, flexibility, and resilience to chewing or rough play.
2. **Versatility and Safety:** Rubber toys are versatile in their applications and are often designed to be safe for use by both children and pets.



Testing:

- >Conduct chemical testing to ensure the rubber material is free from harmful substances such as phthalates, BPA, lead, or other toxic chemicals.
- >Engage users, such as children or pet owners, in hands-on testing to assess the toys' usability, comfort, and appeal.
- >Evaluate the toys' ability to resist mold, mildew, and bacterial growth, especially for those intended for use in wet or outdoor environments.
- >Solicit feedback from users through surveys, focus groups, or interviews to gather insights into their overall satisfaction, preferences, and any areas for improvement.

Benefits of Low-Fidelity Prototype:

- Quick and inexpensive to create.
- Focuses on core functionalities and user flow.
- Allows for early feedback and iteration before complex development.

Future enhancement:

1. Interactive Features: Develop rubber toys with interactive elements such as LED lights, sound effects, or Bluetooth connectivity, to engage children in imaginative play and stimulate their senses.
2. Smart Toys: Integrate smart technology into rubber toys, enabling them to interact with mobile apps or other connected devices, fostering learning, creativity, and social interaction.
3. Augmented Reality (AR) Integration: Create rubber toys that work in conjunction with AR applications to provide immersive and educational experiences, bringing virtual worlds to life and encouraging exploration and discovery.

4. Customization Options: Offer personalized rubber toys that allow children to customize their appearance, features, or accessories, promoting creativity, self-expression, and emotional attachment.
5. Sustainable Materials: Explore eco-friendly alternatives to traditional rubber materials, such as biodegradable or recycled rubber compounds, to reduce environmental impact and promote sustainability.
6. STEM Learning: Design rubber toys that incorporate elements of science, technology, engineering, and mathematics (STEM) education, encouraging hands-on experimentation, problem-solving, and critical thinking skills.
7. Multisensory Experiences: Create rubber toys that provide multisensory experiences through a combination of textures, colors, sounds, and scents, stimulating cognitive development and sensory exploration.
8. Inclusive Design: Ensure rubber toys are designed with inclusivity in mind, considering factors such as accessibility, cultural diversity, and varying abilities to ensure all children can enjoy and benefit from play.
9. Safety and Health Monitoring: Develop rubber toys with built-in sensors or biometric tracking capabilities to monitor children's activity levels, vital signs, or environmental conditions, promoting health and safety.
10. Educational Content: Embed educational content, such as storytelling, language learning, or problem-solving challenges, into rubber toys to provide enriching and age-appropriate learning experiences.

PRACTICAL 6

Aim: Have participants take test their prototype with potential users and gather feedback on what works, what doesn't work, and what could be improved

Survey:

- >How engaging did your child find the rubber toy prototype? Please rate on a scale of 1 to 5, with 1 being not engaging at all and 5 being highly engaging.
- >Is there anything you would change or improve about the rubber toy prototype?
- >What did you like most about playing with the rubber toy prototype?
- >What did you like least about playing with the rubber toy prototype?
- >Overall Impressions: Based on your experience with the rubber toy prototype, please provide any additional comments or suggestions for improvement.
- >Demographic Information: Your demographic information will help us better understand the needs and preferences of our target audience. All responses will be kept confidential.

Number of Children in Household:_____

Age Range(s) of Children:_____

Household Income:_____

Location (City, State/Country):_____

Thank you for taking the time to provide feedback on our rubber toy prototype. Your input will help us enhance our product to create a more enjoyable and enriching play experience for children.

PRACTICAL 7

Aim: Based on the feedback, have participants refined and iterate on their prototype to improve its usability, functionality and appeal.

1. Review Feedback:

- Gather all feedback collected from participants, including comments, suggestions, and ratings on different aspects of the prototype.
- Identify common themes, patterns, and areas for improvement that emerged from the feedback.

2. Prioritize Enhancements:

- Prioritize enhancements based on the feedback received, focusing on addressing the most critical issues and areas with the greatest potential for improvement.
- Consider factors such as safety concerns, usability challenges, engagement levels, and alignment with user preferences.

3. Usability Improvements:

- Address usability issues identified by participants, such as difficulties in gripping, manipulating, or interacting with the toy.
- Refine the design and ergonomics of the toy to enhance ease of use for both children and caregivers.
- Simplify any complex features or mechanisms to make them more intuitive and user-friendly.

4. Functionality Enhancements:

- Incorporate enhancements to improve the functionality and performance of the toy, based on user feedback.
- Fix any technical issues or malfunctions reported by participants, such as non-responsive buttons, broken parts, or inconsistent behavior.
- Integrate new features or interactive elements that align with user preferences and enhance play value.

5. Appeal and Engagement Boosters:

- Enhance the visual appeal and aesthetic design of the toy to make it more attractive and appealing to children.
- Incorporate feedback on colour choices, patterns, textures, and overall appearance to create a more engaging and visually stimulating product.
- Introduce storytelling elements, characters, or themes that resonate with children's interests and imagination, increasing emotional connection and play value.

PRACTICAL 8

Aim: The aim of this practical is to have participants test their prototype with potential users (in this case, college students using public transportation), gather feedback on what works, what doesn't work, and what could be improved. The feedback will be used to refine the prototype further and improve its effectiveness.

Prototype :Real- Time Bus Tracking Mobile App for College Students

Survey for User Testing:

To collect feedback on the mobile app prototype, participants will distribute a feedback survey to a group of college students who have used the app for testing. The survey will help gather insights about usability, functionality, and areas for improvement.

Demographic Information:

The following demographic questions will help us understand the target audience's background and how their experiences with public transportation might influence their feedback.

Age: _____

Year of Study:_____

Mode of Transportation Used Most Often: _____

How often do you use public transportation? _____

Location: _____

Student Implementation Example:

Let's see how students might implement the feedback survey and gather insights after testing the mobile app.

Step-by-Step Process for Gathering Feedback:

1. Initial Testing:

Students conduct initial testing with a group of college students. The users are given access to the mobile app, and they are asked to use it for a few days in real-life commuting scenarios. For example, the users track buses in real-time, plan their routes, and receive notifications about the bus's arrival.

2. Survey Distribution:

After the testing period, students distribute the feedback survey to the users either via an online platform (Google Forms, Typeform) or through paper

forms. The survey is designed to gather both qualitative and quantitative feedback.

3. Data Collection:

Students collect and organize responses. They may use a simple Excel sheet or a feedback analysis tool to tabulate scores, identify trends, and summarize comments.

4. Analysis:

After collecting the responses, students analyze the feedback:

- Quantitative data: Look at the average ratings for usability, satisfaction, and engagement.
- Qualitative data: Identify recurring themes in open-ended responses, such as common issues, feature requests, or aspects users particularly liked.

5. Iteration:

Based on the feedback, students make adjustments to the prototype. For example:

- If many users reported that the route planner wasn't as intuitive, the interface may be redesigned for better ease of use.