P3 Report

Designing an intervention that assists architects to incorporate traditional architectural practices.

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Approval Sheet

The Interaction Design Project- 3 titled "Designing an intervention that assists architects to incorporate traditional architectural practices" by Shivangi Negi, Roll Number 216330018 is approved in partial fulfillment of the Master in Design Degree in Interaction Design, Indian Institute of Technology Bombay.

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Declaration

I hereby declare that this document contains my original ideas and exploration. I have adequately cited and referenced the original sources wherever they have been used as a part of this project. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/ 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 sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

This project aims to revive and promote traditional architecture practices, specifically focusing on the Kath Kuni style, in Himachal Pradesh, India. The project involves the development of a Kath Kuni plugin for the BIM software Revit, targeting architecture professionals interested in integrating Kath Kuni elements into their designs. The plugin provides assistance during analysis, drafting, and editing processes within Revit, facilitating the seamless integration of traditional architectural elements.

Additionally, a dedicated website has been designed to serve as a repository for various styles of traditional architecture in India. The website not only provides access to the Kath Kuni Plugin but also features a discussion forum and an open-source component library. These interactive features foster collaboration, knowledge sharing, and the exploration of traditional architecture.

The project follows an iterative approach, incorporating feedback primarily from novice architects in Kath Kuni and discussions throughout the research, analysis, and wireframe stages. This iterative process ensures that the plugin and website meet the specific needs and preferences of architects working with the Kath Kuni style, ultimately contributing to the revival and preservation of traditional architecture in Himachal Pradesh and beyond.

Contents

Terminologies

1. Zoning: Zoning is the grouping of spaces or sub-parts of spaces such that the resulting spatial layout is logical from a disciplinary perspective.
2. Sustainable: Sustainable architecture perspective that consumes less embodied energy, economic.
3. RCC Framework Construction Method: Contemporary method of construction, which uses Cement, mortar, etc to create a structure. This design pattern is observed to be similar across.
4. Hybrid Construction: Creating Traditional and Contemporary design
5. Novice Architect: The architect is Novice in Kath Kuni

1. Introduction

1.1 Commercialisation of Architecture in Himachal Pradesh

Himachal Pradesh, located in a seismically active zone, has faced numerous earthquakes and other natural disasters. It falls in high-risk seismic zones IV & V, experiencing over 1,300 earthquakes in the last century. According to S.S. Randhawa, Principal Scientific Officer at State Center for Climate Change in Shimla; “After perusing the epicentre data plotted, it has been found that Himachal Pradesh has been rocked by more than 1,300 earthquakes during the last 100 years,” .The region also encounters frequent landslides, cloudbursts, heavy rainfall, snowfall, and extreme winter and summer conditions.

These factors highlight the vulnerability of Himachal Pradesh to various climatic and geological hazards. Climate change has a variety of effects on buildings, including extreme weather events and slope failures.

Seismologist Naresh Kumar from Dehradun's Wadia Institute of Himalayan Geology said: "The states are designing their new public buildings to be earthquake resistant, but majority of their private houses are still not aseismic. The new constructions lack design that helps the house bear shock waves." The current construction practice of R.C.C. Framework & Brick house has become similar across Indian. It is becoming popular, because it is believed to be more economical, & is quick and requires less skilled labor.

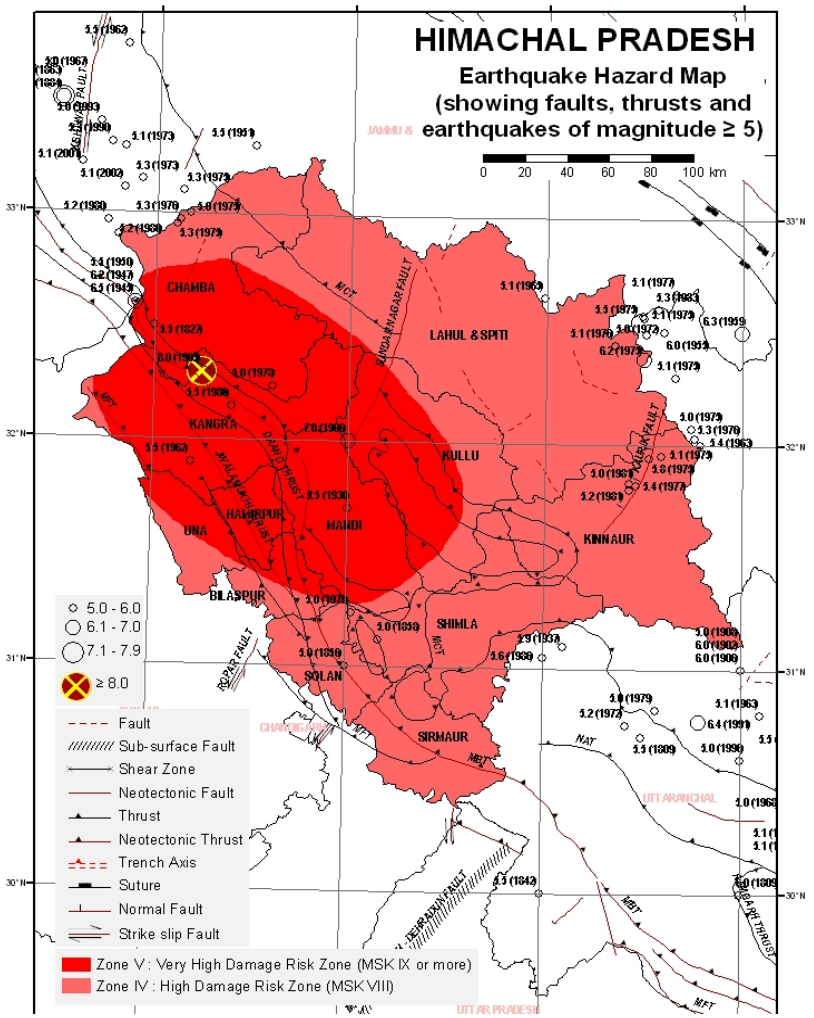


Fig1 : Epicentral and Earthquake Hazard Map of Himachal Pradesh. (Source BMTPC Vulnerability Atlas of Himachal Pradesh)

Their long-term effects on climate change have not been well studied. These practices are unsustainable, harmful to the environment and they are less energy efficient. They also are not tailored to the geographic conditions, culture & tradition of the local population.

Fig 2 : Current construction Practices in Solan, Himachal Pradesh

1.2. Relevance and sustainability

A large portion of the traditional building stock in the Indian Himalayas (and also in the Karakoram mountain range in Northern Pakistan, near the Chinese border and parts of Afghanistan (Hughes, 2000) (Langenbach, 2015)) is represented by the “Kath-Kuni” style of building. Kath-Kuni literally means “wooden corner” in the local Himachal language. Kath-Kuni buildings are never conventionally engineered, but a consequence of progressive design optimisation, built with knowledge of local people and improved over centuries of time. The Indian Himalaya has always been an earthquake-prone area and inhabitants of the mountains learned to deal with this unavoidable natural hazard by improving the techniques in their local architecture. As a consequence, apparent earthquake-resilient structures evolved. Provided that the structures are well maintained, centuries old Kath-Kuni buildings are robust and well preserved, which shows this building’s high durability.

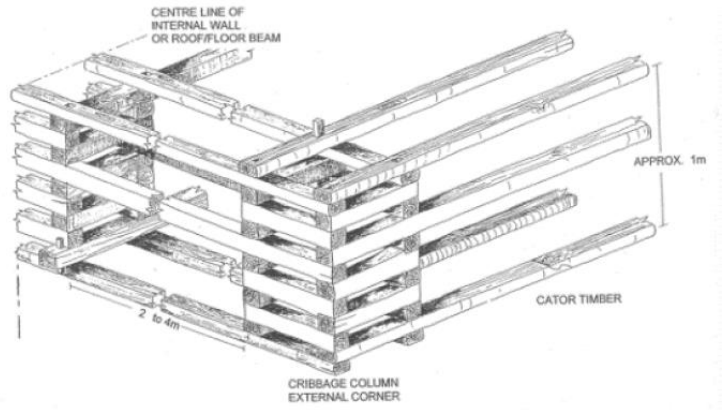


Fig 3 : Details of Cator and Cribbage Construction in Pakistan (Hughes, 2000)

Nevertheless, there is an increased trend in building on hilly slopes using new building techniques like reinforced concrete (Figure 2). The traditional Kath-Kuni building method is nowadays not so often build and building knowledge slowly gets lost. This is mostly due to the beliefs associated with RCC(modern construction method), & belief of scarcity of the traditional building materials. Nowadays, local carpenters are influenced by modern techniques, which might not always be

an improvement. The viability of these settlements is now in doubt as a result of the escalating need for more space brought on by population increase, the quickening improvement of construction techniques & affordability.

Himachal is rich in cultural heritage, & the present-day construction poorly reflects it.

Fig 4 : Storytelling represented through intricate woodwork in Kath-Kuni Design in Himachal (Source: https://www.sahapedia.org/the-himalayan-vernacular-kath-khuni-architecture)

Fig 5 : Storytelling represented through intricate woodwork in Kath-Kuni Design in Himachal

1.3 Stakeholders in Construction

There are multiple stakeholders that come into picture when it comes to construction of a space like Architect, Builders, Construction Workers, Artisans, and the residents of the space. Multiple variables affect the design and construction of the house. Some common variables being Affordability, Time taken, Topography, Climate, Residents and Their Needs,Culture and Traditions, Emerging Construction Techniques, Building Materials, Lack of Knowledge and the right skills.

1. Architects: Design structures, collaborate with clients, and communicate with peers.
2. Builders and Contractors: Construct Kath Kuni structures, manage construction process.
3. Craftsmen and Artisans: Skilled in Kath Kuni techniques, contribute to detailed craftsmanship
4. Engineers: Ensure structural stability and safety, collaborate with architects and builders.
5. Material Suppliers: Provide high-quality materials for Kath Kuni construction.
6. Government Authorities and Regulatory Bodies: Enforce building codes and regulations.
7. Clients and Homeowners: Provide input and collaborate on design and execution.
8. Community and Local Residents: Consider local opinions, concerns, and cultural considerations.

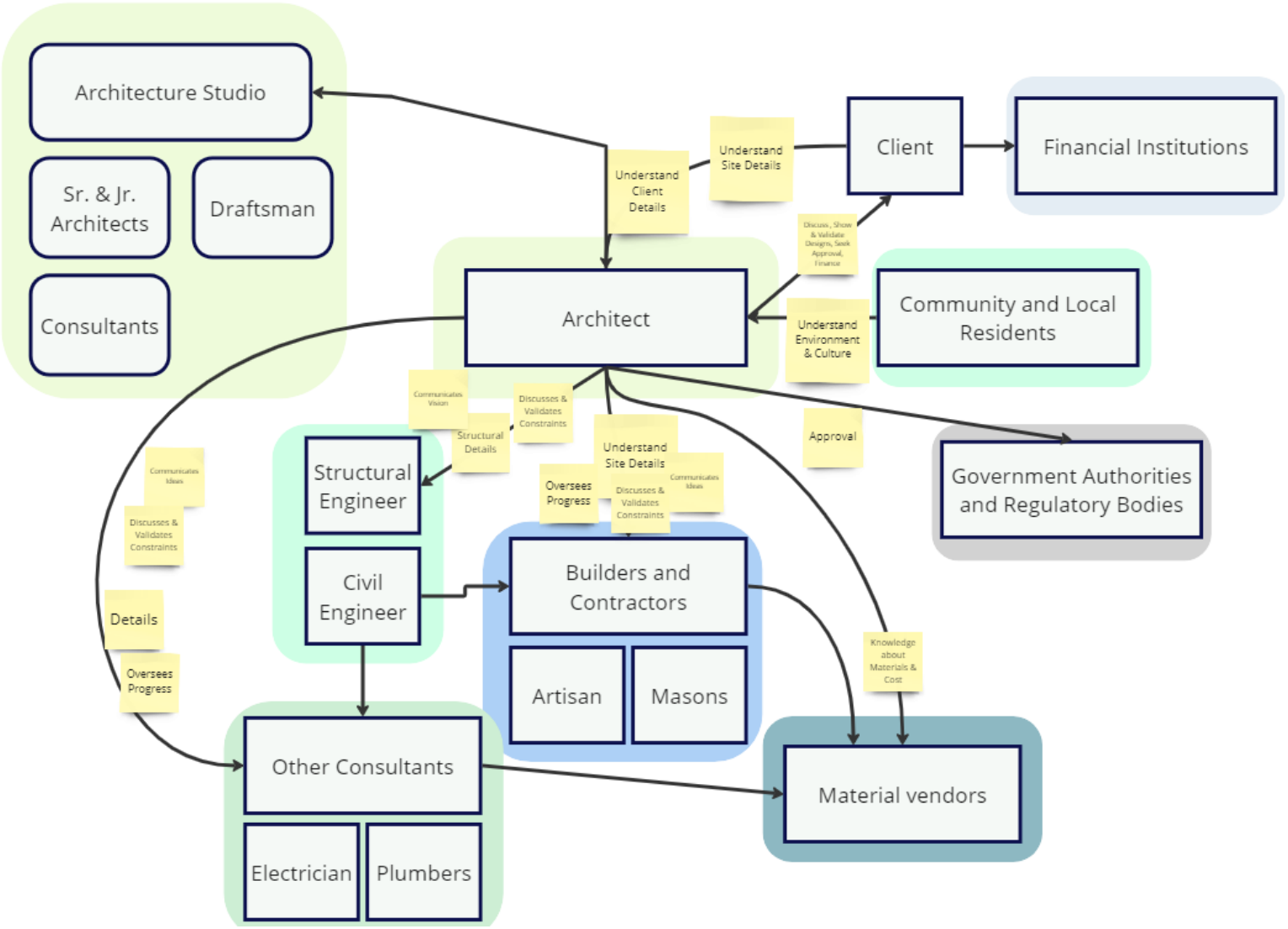


Fig 6: Stakeholder & Their Roles

Every Interaction of an Architect with any of the stakeholder is a learning opportunity. It gives new insight as to how the design and construction can be improved.

Since it is mandatory by law to include an architect in the project, each project, despite its scale will have an architect. It is the architect, whose design is being executed, and they have to oversee and aid in the entire construction process. Hence the Architect plays a vital role in ensuring a sustainable construction.

1.4 What is Traditional Architecture?

Traditional architecture refers to building practices rooted in the present context and location, incorporating local cultures, materials, and environments. It encompasses various building types and styles, adapting the structure, function of spaces, and required services. It is characterized by the use of local materials, construction techniques, and design features that suit local climates, landscapes, and cultural practices. Traditional architecture represents the collective wisdom of communities, reflecting their values, beliefs, and social structures, while preserving cultural and historical identity. Architects and designers often draw inspiration from traditional practices to create energy-efficient, environmentally sustainable, and culturally sensitive buildings.

1.4.1 Traditional Architecture in present context

Upon interviewing several Architects & Architect Researchers, during my primary research, the definition and use cases varied about traditional architecture. But all of them focused on the fundamentals of Traditional Architecture.

In the present context of Himachal Pradesh, traditional architecture has evolved to meet the changing needs of residents. The introduction of amenities like electricity, plumbing, and water supply has influenced the design of houses. Previously, residents spent more time outdoors during summers and focused on creating an ambient indoor temperature during winters. Houses had thick walls for insulation, small openings, and space for sheltering livestock. However, residents now desire larger windows to enjoy views and prefer to spend summers indoors with warm daylight entering the house. Modern amenities such as electricity, water supply, plumbing, and septic tanks have become essential but still align with the fundamentals of traditional architecture. Locally sourced materials like timber, stones, mud, cement, bamboo, and brick are used, with cement used alongside traditional materials to withstand seismic loads. Design elements like pitched roofs and thick walls for insulation and snow load prevention remain relevant. Incorporating culture, heritage, values, and beliefs enhance the user experience. Traditional architecture in this context focuses more on the construction aspect of the building, while the services and user needs continue to evolve.

Fig 7 : Present day amenity of power supply incorporated in the design of Kath Kuni.

2. Aim

The primary aim of the project is to revive and promote traditional architecture practices in Himachal Pradesh. The intent is to integrate the valuable knowledge and principles from traditional architecture into contemporary designs, creating effective houses that are well-suited for the region.

3. Scope

- This project focuses on architects. It focuses on providing them with the necessary tools, knowledge, and resources to revive traditional architecture practices in the region. For context the region is Himachal Pradesh.
- The style of Architecture is Kath Kuni.
- Revival does not mean elimination of contemporary RCC structures. The learnings could be utilized & incorporated with present construction methods to create a sustainable design. It is for clients, architects & other stakeholders who are interested in knowing about the Kath Kuni style of architecture.

4. Methodology

The methodology employed for this project was iterative and collaborative, acknowledging the non-linear nature of the process and the need for multiple iterations and back-and-forth interactions. The following approach was adopted:

1. Initial Research and Documentation: Conducting thorough research and documentation of the traditional Kath Kuni architecture practices specific to Himachal Pradesh, including building techniques, materials, design principles, and cultural significance. This included studying historical references, interviewing

2. experts, and analyzing existing structures. The site surveys & documentation done in the Kullu & Kinnaur districts of Himachal Pradesh.
3. Engagement with Stakeholders: Architects, and other stakeholders were engaged in discussions to gather insights, understand their perspectives, and identify their specific needs and requirements regarding the revival of Kath Kuni architecture. Understanding the process, needs & wants of the architect & the other stakeholders.
4. Initial Literature review: Understanding in detail the nuances of Kath Kuni Architecture.This aims to identify the fundamental principles of Kath Kuni architecture, explore the distinctive characteristics of this architectural style, and investigate contemporary advancements and innovations in the field. Additionally, case studies, talks, & research papers were studied to examine how organizations are incorporating Kath Kuni practices and other traditional architecture practices into their designs and construction projects.
5. Analysis: Gathering Insights from Primary & Secondary Interview, Segregating content of kath kuni in simple and easy to understand way, Construction and Architects journey to identify gaps. Identifying possible design interventions.
6. Revised Problem Statement, Aims & objectives
7. Persona: of a Novice and Expert architect in Kath Kuni
8. Primary, Secondary Research & Analysis:
   Digital Tools that the architect uses, understanding the scope of these tools, studying AI & its scope in Architecture. Design Language of Revit.
9. Design and Development Iterations: Multiple design iterations were undertaken, incorporating feedback and suggestions from stakeholders. The designs were continuously refined and adjusted to strike a balance between traditional elements and contemporary construction methods, ensuring sustainability and functionality.
10. Prototyping and Feedback: Prototypes and models were developed to visualize the design concepts. Feedback from architects, clients, and other stakeholders was collected to evaluate the feasibility, aesthetics, and usability of the proposed designs.
11. Continuous Improvement: Throughout the project, feedback loops were established to gather insights from the stakeholders and make necessary adjustments. This iterative process allowed for continuous improvement and refinement of the design concepts based on practical considerations and user feedback.
12. Final Evaluation: Think aloud usability evaluation

5. Understanding Architects & Their Process

For my primary research I reached out to 2 organisations.

The objective was to understand the "whats" and "whys" behind the use of Kath Kuni architecture. Firstly, an investigation was conducted to gain insights into the design process of skilled and novice architects in Kath Kuni, including their architectural processes and the tools they employ. Additionally, an exploration of the different traditional architecture styles in Himachal was undertaken to understand their relevance and significance to Kath Kuni. This research also involved engaging with pioneer architects who have implemented various architectural techniques for Kath Kuni while considering the available resources and the evolving needs and services of users. Furthermore, an effort was made to connect with local artisans who work on Kath Kuni construction sites to comprehend their process and perspective. The research aimed to uncover the standards followed by these artisans in their craftsmanship. Conversations were also held with individuals residing in traditional Kath Kuni designs, and documentation of the architectural style was undertaken. These primary research activities provided valuable insights that were instrumental in developing a solution to promote and encourage the

integration of Kath Kuni practices in local architecture in Himachal.

5.1 North

Ar. Rahul Bhushan, Founder & Principal Architect

North is an esteemed organization dedicated to preserving and raising awareness about Himalayan traditions while revitalizing the artistic lineage inherited from master craftsmen. They prioritize creation, documentation, research, and restoration of traditional practices in Himachal Pradesh. Their architectural practice emphasizes sustainability, meeting user needs, time and cost effectiveness, climate responsiveness, energy efficiency, and minimal environmental impact.

Their expertise lies in working with locally available materials such as bamboo, RCC, and repurposing existing components. During my meeting with the Architecture Team of North, I sought to understand their process in building creation. Specifically, I inquired about the distinctions between designing a standard house and a hybrid design, their perception of traditional and hybrid architecture, the client's perspective, and the contemporary significance of traditional architecture. I also sought insights into their motivation to continue this practice and whether there is a demand from their clientele. Their architectural process involves thorough field and secondary research, client consultations, and a comprehensive questionnaire covering various parameters like budget, time, site conditions, desired spaces, structural

functions, and material availability. Site visits are crucial for understanding site-specific elements such as topography, sun path, and wind flow.

The initial design phase includes client preferences, needs, and site considerations, resulting in multiple design options. 2D plans, sections, and elevations are developed, alongside 3D models. Collaborating closely with skilled artisans and masons, North communicates their ideas and engages in fruitful discussions on feasible solutions.

Architecture techniques often blend traditional and modern elements to harmonize with the site context, with discoveries and adaptations made on-site through a non-linear, trial-and-error approach. Building analysis using BIM helps evaluate the impact of seismic loads, and BIM is also employed for drafting 2D drawings and 3D models.

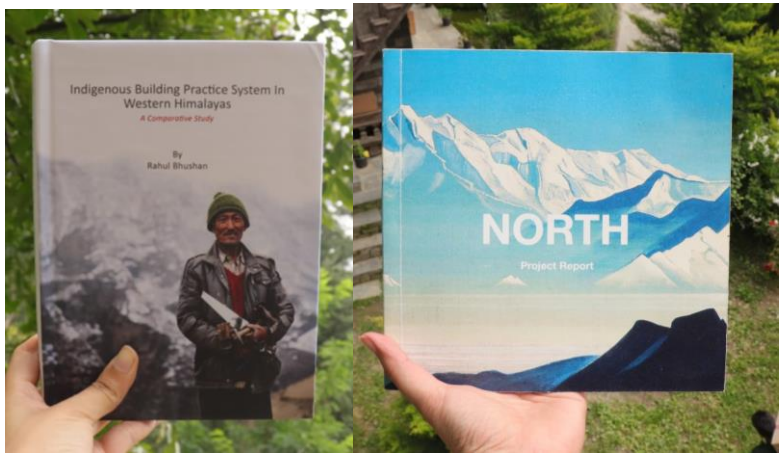


Fig 8: Publications by North that were really helpful in my Research.

5.2 CBRI, IIT Roorkee

Ar. S.K. Negi, Principal Scientist, Dept. Arch & Planning, IIT Roorkee

Ar. S.K. Negi and his team at CBRI, in collaboration with the Central Government of India, conducted extensive documentation of traditional architectural practices in regions like Himachal Pradesh, Uttarakhand, and other states across India. Through their research, they gained a profound understanding of the underlying reasons and techniques behind these practices. With considerations of the current

scenario, client budgets, natural calamities, and climatic conditions, they developed evolved architecture construction practices that are relevant to the present context.

The project's outcome, a series called Pahal, serveas s a comprehensive guide for individuals residing in these states, including those belonging to the Below Poverty Line (BPL) segment, enabling them to design affordable and sustainable houses. The allocated budget for these houses ranged from 2 to 5 lakhs.

Interviewing Ar. S.K. Negi and witnessing his presentation shed light on the risks associated with the commercialization of architecture. It became evident that disregarding traditional design practices can result in unsafe homes prone to collapse, even during minor tremors. This emphasized the importance of understanding the rationale behind each decision in traditional practices.

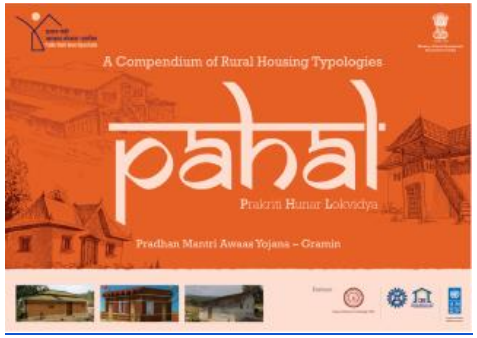


Fig 9: Pahal Publication Vol1 & 2 : A compendium of rural housing typologies.

5.3 Interview with Novice Architects in Kath Kuni

I interviewed six architects with 2 to 6 years of experience, some from Himachal and others from different parts of the country. Despite their lack of familiarity with Kath Kuni architecture, they demonstrated expertise in other areas of architecture and construction. I provided them with an overview of Kath Kuni and asked them to describe their approach when designing something unfamiliar. The objective was to understand their adaptability and the challenges they faced in working with unfamiliar architectural styles like Kath Kuni. The architects were given a brief for designing a traditional Kath Kuni-style residence on a 10m x 12m plot in Kullu, Himachal Pradesh. The client's requirements included two bedrooms, two bathrooms, one kitchen, and one pangat, with insulation and a budget of 25 lakhs. I documented their design process, the steps they adopted, the reasons behind their choices, the tools they used, and the parameters they considered. This research aimed to provide insights into their process, of working on unfamiliar architectural styles.

How will you design the house accordingly? Why do they need to adopt that step? What do they learn from the steps? What are the tools that they use? What are the parameters that they consider?

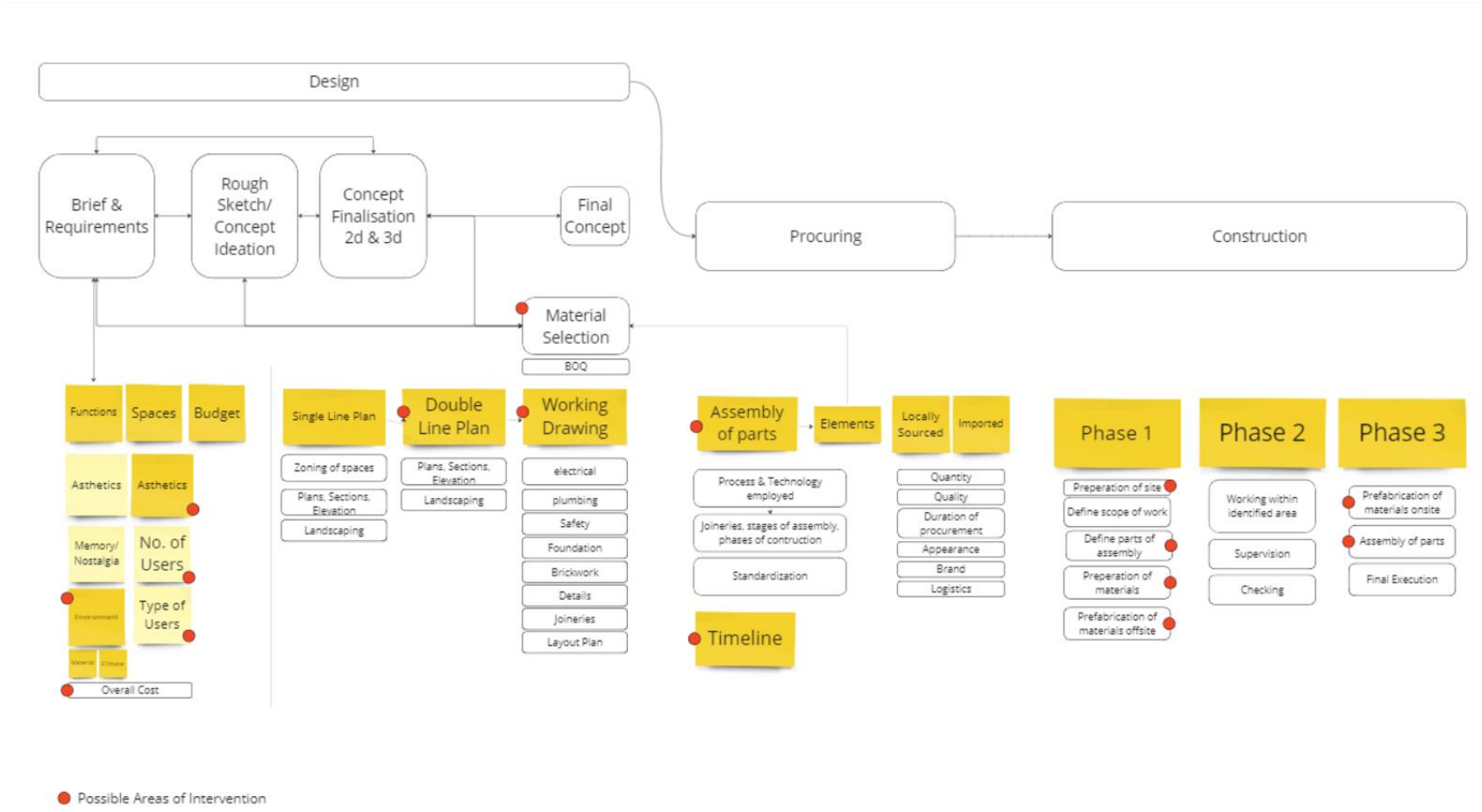


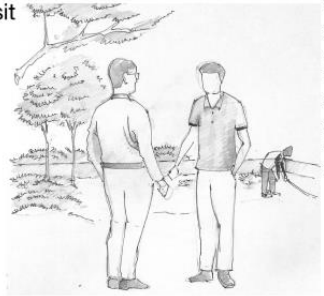
Fig 10: Overall Process of Creating a building. Yellow notes: Major requirements under each step.Under that the subcategories of requirements. Stage 1

5.3.1 Architect's Process

Client Meeting

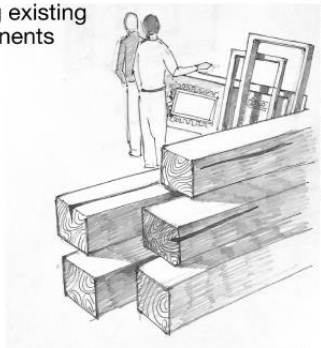
The architect and the client are discussing about the project requirements, the style of architecture. They are also talking about the budget, site and time frame of the project.

Site Visit



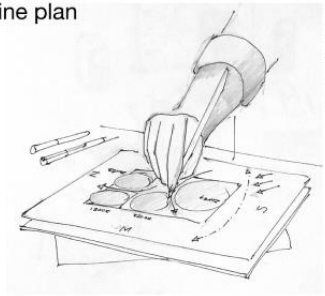
The architect and the client are doing a site visit. Here the architect is learning about the site conditions, such as soil type, vegetation, site dimensions, surrounding buildings. etc.

Finding existing components



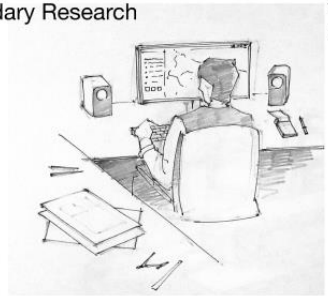
The architect and the client are visiting a place where the client has collected some existing components which she/ he wants to use in the building. They are assessing the condition of these components.

Single line plan



The architect is preparing the zoning plan. This is the first level of designing where all the activites are divided vertically and horizontally.

Secondary Research

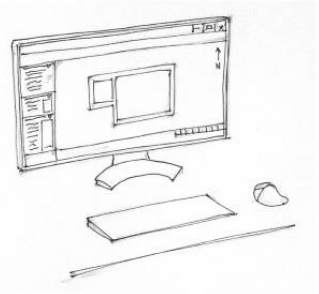


The architect would do research on the relevant parameters

Communication on Site with stakeholders

The architect is discussing the drawings with the local artisan and evaluating them.

Drafting



The architect is drafting the final executable drawings that are to be used on site for construction of the building

Fig 11: Process of an Architect

An architect's role is not linear; they are often appointed as a 'one-stop shop' responsible for designing, supervising, and sometimes even building projects. Managing the design process can be complex, as multiple design alternatives are typically created and evaluated. Research is conducted at various stages with iterative feedback.

In addition to artistic design, architects also run small businesses, manage teams, market their firms, and secure new business. Effective communication with clients is crucial to meet their needs. Architects budget, coordinate, and oversee projects, incorporating mechanical, electrical, plumbing, and other details into designs. They must adhere to building codes, zoning regulations, and obtain project approvals and permits. Construction documents with detailed structural and material information are prepared. Architects collaborate with contractors during construction to ensure compliance and protect the future occupants' health, safety, and welfare.

However, architects face constraints such as budget limitations, client preferences, building codes, and practical considerations. Each project is unique, requiring various combinations to address specific requests and design challenges. The ultimate goal is to achieve clarity, accuracy, and relevance in the design process.

Major categories of an Architects Process.

1. Client Meet: Information gathering phase to understand clients' personality, lifestyle, needs, and space requirements for the project. The collected data is organized into a document detailing rooms, sizes, and desired features.
2. Site Visit: Surveying existing conditions, researching site context, regulations, and cultural aspects. Clients actively participate by providing personal information and completing assignments for better understanding and personalized design.
3. Research: Vital for project development, including client meetings, site analysis, and historical research, forming the project's foundation.
4. Zoning: Exploring design concepts based on site variables, topography, functions, and aesthetics. Initial sketches and plans are prepared.
5. Working Drawing: Detailed construction documents with precise dimensions, specifications, and notes to communicate design intent to the builder.
6. Site Supervision: Architects shift to project management, making regular site visits to ensure adherence to plans.
7. Double Line Plan: Advancing design based on approved concepts, refining indoor and outdoor layouts, and producing drawings for preliminary cost estimation.

8. Including Vendors: Architect engages vendors for building materials, electrical, plumbing, and carpentry services.

5.3.2 Insights

The insights gained from the design process highlight potential areas where the solution could intervene effectively, particularly during the Conceptualization and Research stage. -

- It became apparent that architects faced challenges due to limited access to relevant and reliable resources, such as scarce information on Kath Kuni architecture available online.
- Finding skilled artisans who possess knowledge and expertise in traditional techniques is also becoming increasingly difficult due to the prevalent use of simplified RCC designs.
- Architects often lack confidence in their decisions and face uncertainty about the correctness of their approach, primarily because they lack trusted sources of information. Additionally, designing with non-standard dimensions, as required in Kath Kuni architecture, poses an additional challenge for architects accustomed to working with standardized measurements.
- Moreover, architects express a lack of knowledge regarding the range of materials and construction techniques specific to Kath Kuni design. This knowledge gap inhibits their ability to effectively incorporate these practices into their designs. Furthermore, the architects' limited understanding of the underlying reasons and principles behind the practices of Kath Kuni makes them hesitant to adopt and implement them.

Given these challenges, the solution can play a vital role by providing architects with comprehensive and reliable resources, such as design guidelines, documentation of traditional techniques of Kath Kuni projects. It can offer assistance in conceptualization, offering insights into the design process, material selection, construction techniques, and integration of traditional elements. By addressing these knowledge gaps and providing practical guidance, it can empower architects to confidently embrace and apply Kath Kuni practices in their designs, bridging the gap between tradition and modern construction practices.

Most of the gaps that had an opportunity to be addressed were in the research, Analysis and Ideation Stage.

The Table of architects process (Fig. 11 & Fig 12) gave me a thorough understanding of the different parameters involved. It helped me in understanding and articulating the gaps in a better way.

The next step was to understand the Ideation, Analysis and research stage thoroughly. This helped me understand what motivates the architect to take design decisions at these stages.

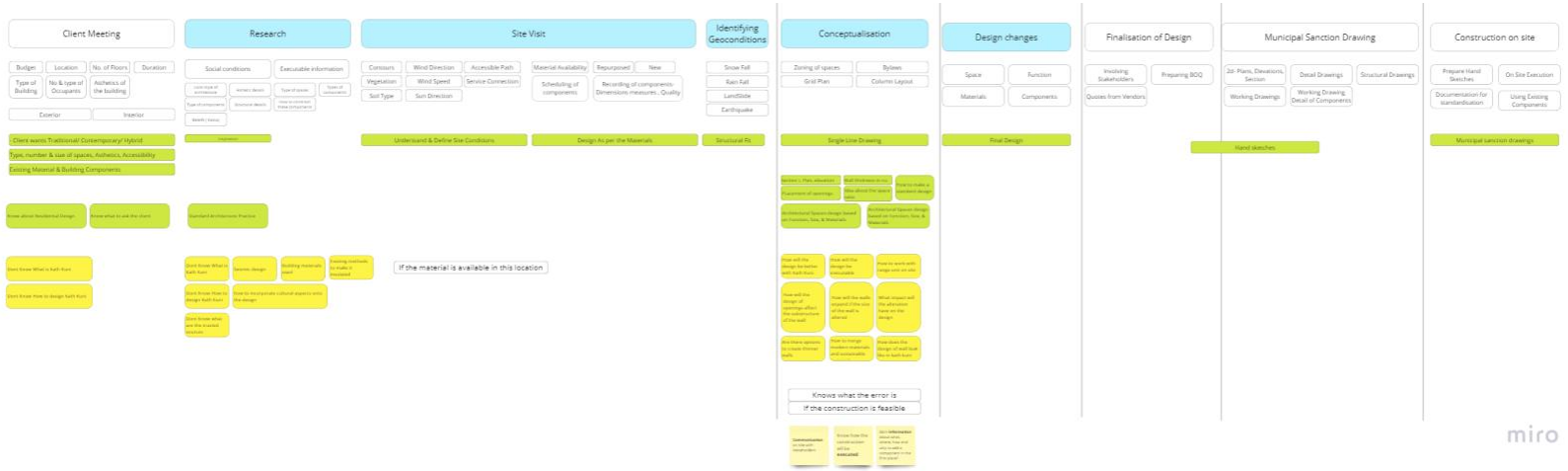


Fig 12 (stage 2): Architects process. Evolved from Fig 10. Row 1 highlights the major steps, Second category of the row are the variables, Category 3: What architect needs to know, Category 4: What they already know, Category 5: Queries that the Architect might be thinking about (Gaps) .

What an Architect Does	Collect Info					Analysis+ Ideation			Execution
Goals	- Gather Information related to the site & client					Schematic Design		Design Development and Construction Document	Coonstruction Administration
Steps	Client Meeting & Analysis	Site Visit & Analysis		Research		Zoning	Single Line Plan	Double line plan & Working Drawing	Site Supervision
		On Site	Offsite	Primary Research	Literature Review				
Stakeholders	Client & Architect	Client, Architect, Contractor, Engineer	Client, Architect, Contractor, Engineer	Client, Architect, Contractor, Engineer, artisans, masons, consultants		Client, Architect, Contractor, Engineer, artisans, masons, consultants	Client, Architect, Contractor, Engineer, artisans, masons, consultants	Client, Architect, Contractor, Engineer, artisans, masons, consultants	Client, Architect, Contractor, Engineer, artisans, masons, consultants
Goals	To understand the client & their requirements	To thoroughly understand the parameters associated with the site		Gaining accurate and trusted information on parameter collected. Information on Kath Kuni style of architecture.		To Allocate Spaces based on the Parameters. To explore different concepts	Add dimensions to the spaces. To explore different concepts	Develop the Design Drawings into a thorough and precise set of Construction Documents. These drawings and specifications have all of the details, dimensions, and notes necessary to communicate the entire design intent to the builder. Estimate BOQ. Project phases, materials needed, services. Create drawings that can be communicated easily on site	The architect's role shifts from creative design to project management. They make regular site visits to ensure that the project is being executed according to their plans. The contractor and their crew assumes control of the project like a film director taking over a screenwriter's script.
Action of the architect	Conducts Interview	Observation, Documentation,Interviews	Evaluation of Information on site, and doing more research offsite to understand parameters better	Search and interact with the right sources, filter information based on what can be actionable & is relevant		Categorising spaces based on Parameters, Allocate the on site map, Create different options. Create 3d concepts	Categorising spaces based on Parameters, Allocate the on site map, Create different options. Create 3d concepts.	Drafting, Prepare BOQ, Site Permission and approval.	Site Visit to ensure that construction is being executed exactly like the drawings. If any changes are to be made based on the feedback from stakeholders, or something is to be communicated, He uses sketches.
How do they do that (process & tools)	Coversation is generally verbal, and they take notes	Images & Videos, Conceptual & technical Sketches, audio recordings	Google maps, Hand drafting, 2d Drafting tools, BIM tools, Research Forums	As mentioned in site visits, and Client Meet, The architect also takes the opinions of stakeholders like contactors, skilled artisans etc.	Reading Articles, Research papers, Case studies, Videos	Hand Sketches	Draft a single line plan on CAD or BIM software/ Hand sketch	Draft a single double line plan on CAD or BIM software/ Hand sketch. Prepare 3d models on CAD/ Handraft/ BIM	Communication with the team. Hand Sktech
What do they gain	-Project type - Scale - Budget - Site, Location - Idea about the type of design (including architectural style) that the client might want - If client has any existing resources that can be reused. - No.of occupants	Location, Neighbourhood context, Zoning and size, Legal information, Natural physical features, Man made features, Circulation, Utilities, Climate, Sensory, Human and cultural Activities and patterns, density, population ethnic patterns, employment, income, values and so on.	2d & 3d drawings & models, Street patterns, Street section, Scale and the hierarchy/formi4space, Land use, Typologies. Neighbourhood relationships, formal street variation, Perspective relationships, views, Edge conditions, surfaces and materials. Natural and man made, Movement and circulation within and around the site, Vehicle vs. pedestrian,Access Public space vs. private space, Open space, History, Climate – sun angles and sun shadows Negative and positive spaces – we move through negative spaces and dwell in positive spaces	Appropriate information to design and construct a structurally sound system that is designed as per the site and client needs.		Basic Idea about the spaces based on client and site needs	SCHEMATIC DESIGN	Double line Plan, Section, Elevation, Working drawings, Construction Details, 3d Renders, BOQ etc	Hand Skecthes. Drafting On Revit.
Gap	Communication.			Scattered Information, Lack of executable information, Some information cannot be trusted, Lack of trusted sources, Time Consuming, Tedious Process		Suggestions from experts, Inspirations on how the design can be improved	Suggestions from experts, Inspirations on how the design can be improved	In Depth knowledge about size of components, building materials, Construction details regarding traditional Architecture might be lacking. Drafting a Component is a tedious and time consuming process. If accurate information is not present, it could be difficult to communicate and execute it on site. It could also lead to a structural failure.	Lack of skilled artisan to execute things on site. Lack of communication about the idea and details.
Possible ways to solve	- Asking the right questions based on context			Providing trusted resources, Creating a repository of Information, Providing Relevant Information		Discussions with different expert. Contact details of experts. Suggestions on the design		- Providing Multiple Combination Of Kaithi Kuni Components. - Easy & Quick Editing to create a new Component - Information about Construction Details of Kath Kuni Component and how it is assembled-	Contact details of the skilled Stakeholders.

Fig 13 (stage 3): Architects process. Evolved from Fig 12. Here the goal was to articulate the gaps and possible solutions. Rows: Architects Steps, Goals, Stakeholders in that step, actions of the architect, Outcome of each category, Gaps and Possible solutions.

5.3.3 What motivates an architect to design

The 2 major parameters that motivate an architect to design are the Experience of the user in the space & the site. These guide in assessing the feasibility of the design.

- Experience of the user(resident): guided by the comfort of the user in the space, navigation & the type of space.
- Parameters of Site

The feasibility of design is guided by time, budget, material availability, construction details & stakeholders

5.3.3.1 How does an architect conceptualize a design?

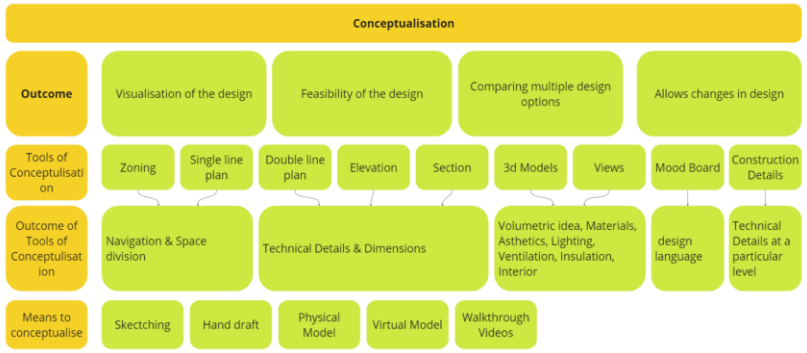


Fig 14 : Understand how an architect conceptualizes

5.3.3.2 How does an architect conduct research

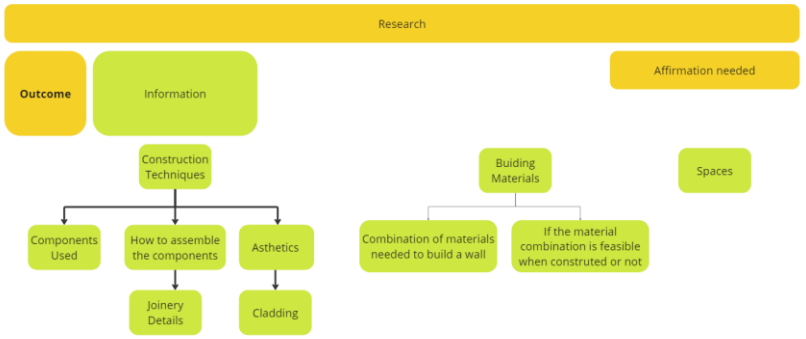


Fig 15 : Information needed for research.

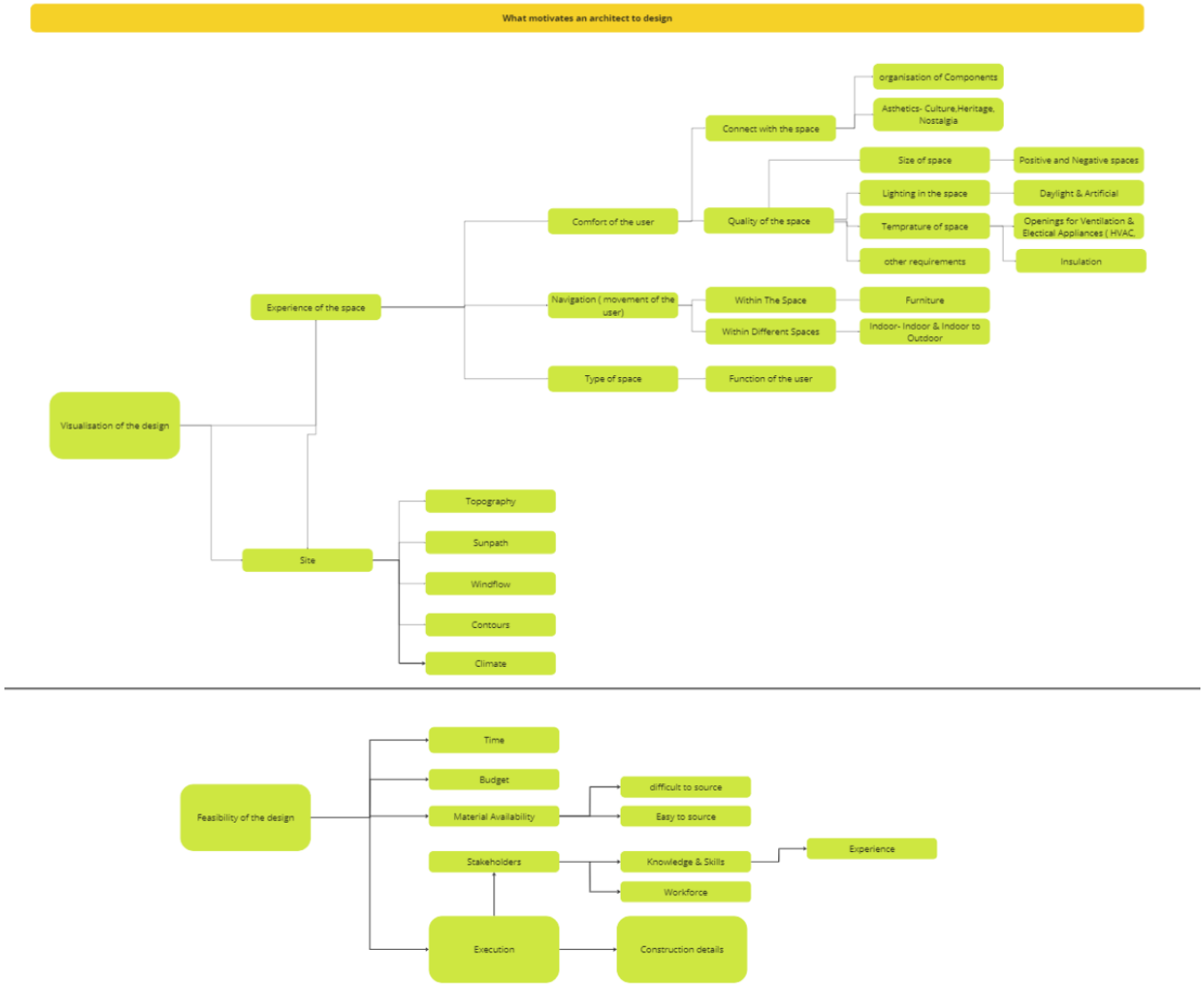


Fig 16 : What motivates an architect

5.4 Architect's Persona

5.4.1 Novice Architect

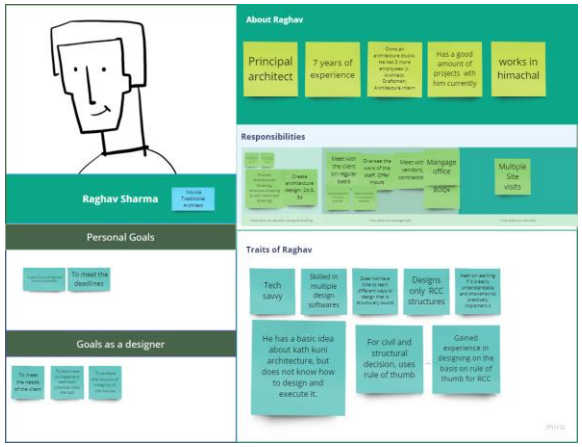


Fig 17 : Novice Architect Persona

Name: Raghav Age: 32 Occupation: Architect (7 years of experience in RCC construction) Experience with Kath Kuni: New (Limited knowledge and experience)

Raghav is an architect from Himachal, with a solid background in RCC framework construction. With seven years of experience in the field, he has worked on various projects, primarily focusing on modern architectural styles. However, Raghav has recently developed an interest in traditional construction techniques, particularly in the unique Kath Kuni architecture of the region. He is eager to expand his skills and knowledge in this area. A client has recently approached him with a Kath Kuni Residential project. He is eager to work on it.

Goals and Needs:

1. Learn Kath Kuni Architecture: Raghav wants to understand the intricacies of Kath Kuni construction, including the traditional building techniques, materials, and design principles.
2. Seamless Transition: Raghav seeks a smooth transition from his RCC background to Kath Kuni architecture, minimizing any knowledge gaps and challenges associated with the new project.
3. Expert Guidance: As a novice in Kath Kuni, Raghav values expert guidance, mentorship, and access to resources that can aid his learning process

Wants

1. to learn & visualize the joinery details, construction techniques, materials of Kath Kuni Architecture.
2. Does not want to waste too much on research required about the local architecture style.
3. Wants a trusted source of information.
4. Wants to communicate precise information and details to the stakeholders on site

Tools he uses: Auto cad and Revit.

5.4.2 Expert Architect

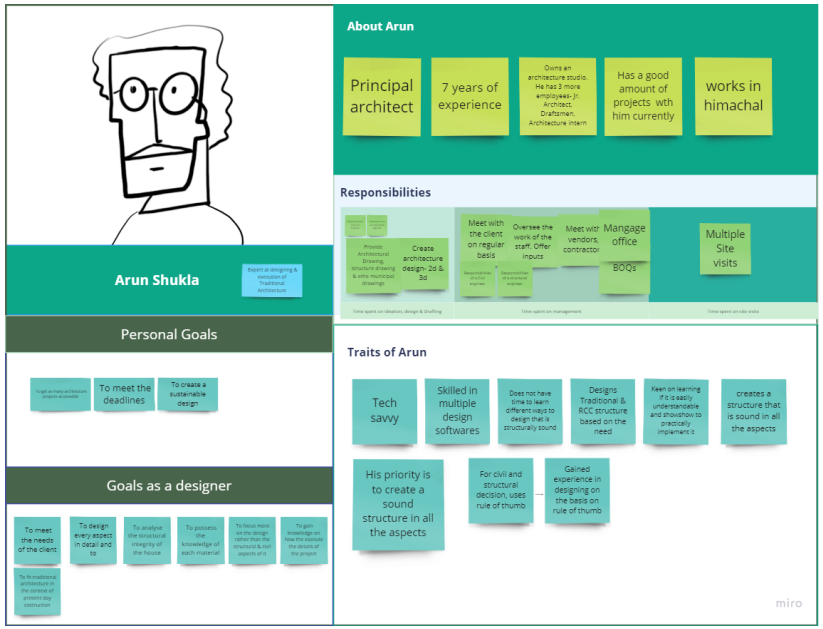


Fig 18 : Expert Architect Persona

Name: Arun Sharma
Age: 32 Occupation: Architect (7 years of experience in RCC construction) Experience with Kath Kuni.

Background:
Arun Sharma is an experienced architect with seven years of expertise in Kath Kuni architecture. He has a deep understanding of the traditional construction techniques, materials, and cultural significance associated with Kath Kuni. Arun's passion for preserving and promoting vernacular architecture has been the driving force behind his career. He has worked on numerous projects, ranging from residential homes to commercial establishments, showcasing his mastery in blending traditional aesthetics with modern functionality.

Goals:

- Promote and preserve the authenticity of Kath Kuni architecture in contemporary designs.
- Create innovative and sustainable solutions that meet the functional requirements of clients while adhering to the principles of Kath Kuni.
- Collaborate with local artisans and craftsmen to support the traditional building techniques and skills associated with Kath Kuni.
- Educate clients and the wider community about the cultural significance and benefits of Kath Kuni architecture.

Pain Points:

- Designing & customizing Kath Kuni on 2d & 3d software is very difficult.
- Limited availability and high cost of skilled artisans and craftsmen who are proficient in Kath Kuni architecture.
- Navigating complex building regulations and codes that may not adequately address or support the unique characteristics of Kath Kuni.

6. Understanding Kath Kuni Architecture

The objectives of secondary research were to Understand the type of architecture that currently exists in Himachal Pradesh. What are the properties of traditional architecture that exist in the space?What are the details of architecture that are currently existing in the space?

What are the tools that the architects currently use to create structures?What are the tools that the architects currently use to create structures? Understand the scope of current tools of architecture. What is the typology of houses that exist in Himachal Pradesh? What are the kinds and functions of spaces that exist in the region?

Fig 19 : Palace in Naggar Kullu built from Kath Kuni Design

Kath-Kuni buildings are distinguished by double horizontal timber beams in part of the strong load bearing walls, which are joined to one another by timber dovetail connectors known as'maanwi's. Overcoming resistance or hesitation from clients who may perceive Kath Kuni architecture as outdated or less desirable compared to modern architectural styles.

- Dry-stone masonry is used to fill the vertical gap between the wooden beams. The beams are joined horizontally at the corners by wooden dowels known as "kadils." The Kath-Kuni building style is the result of continuous improvement by local carpenters and the knowledge passed down from generation to generation rather than being a conventionally engineered design. For Documentation and getting an in depth understanding of the space, I visited 2 locations Kinnaur and Naggar.
- Joineries & standards.
- Dependent on the size and type of Building Materials
- No Mortar/ Cement/ Plaster is used
- Assembled and Dismantled for Re purpose
- Hence the joineries and Construction Techniques Differ
- More time Consuming

Fig 19 : Joinery details in Kath Kuni Design.

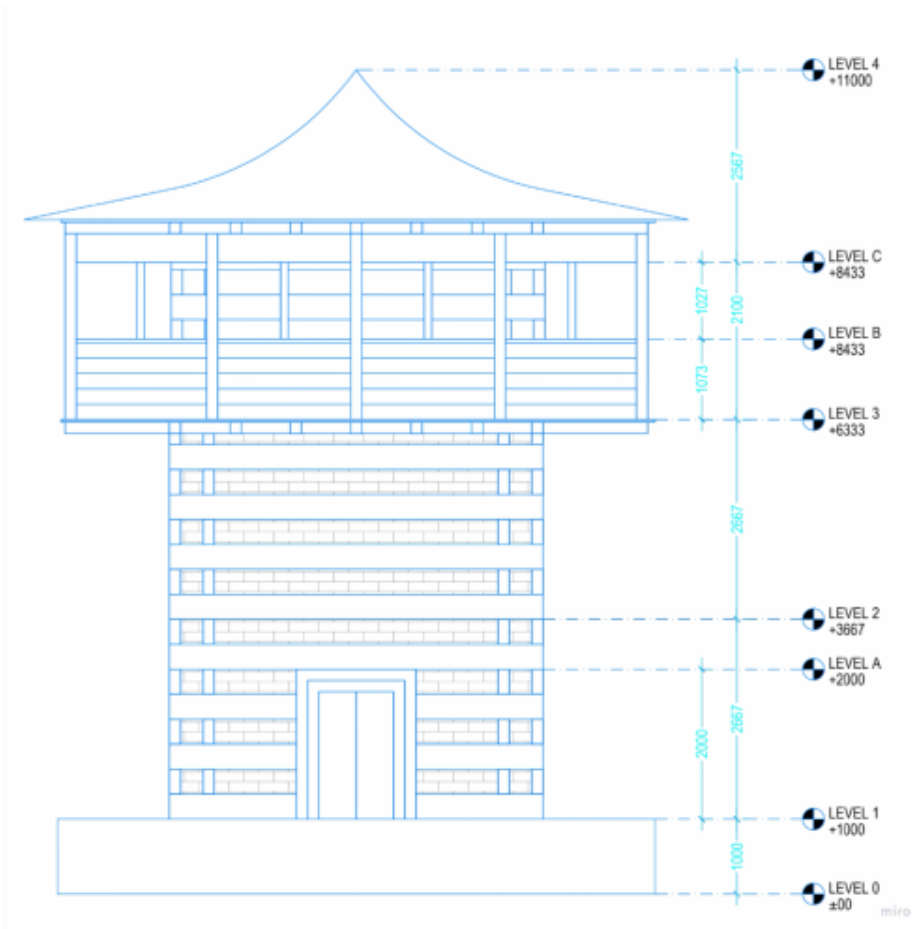


Fig 20: Documentation of a Kath Kuni House

6.1 Typology of House

There are 4 types of houses in Kath Kuni (Matra; Jay Thakkar):

- Residential houses
- Fort Palace
- Temples
- Granaries

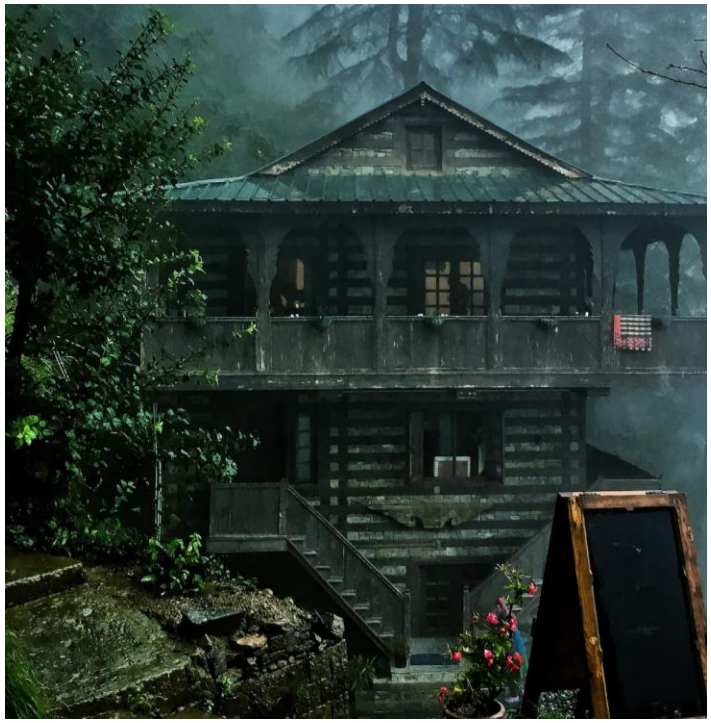


Fig 21 : Kath Kuni House

Fig 22: Granaries

Fig 23: Palace

6.1.1. Residential

The character of a Kath Kuni Traditional House is a " Story Unit." Story Units are stacked one in 2-3 layers vertically which makes the Ground Level, First Level, Second Level. The size of the house increases by placing cuboids side by side and then extending the larger units to 1-2 levels. The capacity of the house was defined by not only the family but also the family's socio economic status.

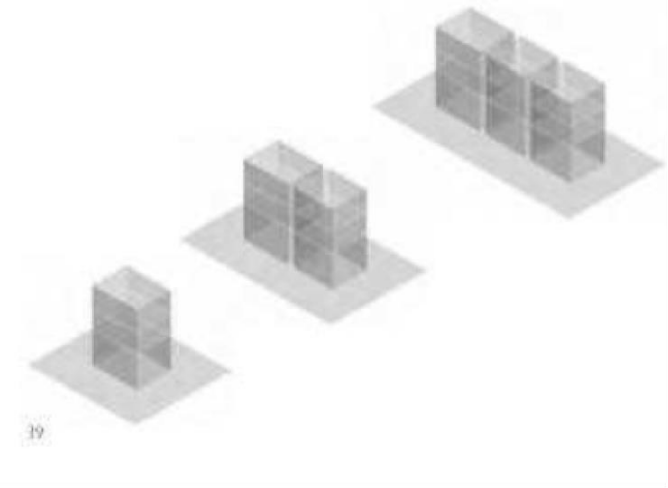


Fig 24: Story Unit in Kath Kuni (Matra, Jay Thakkar)

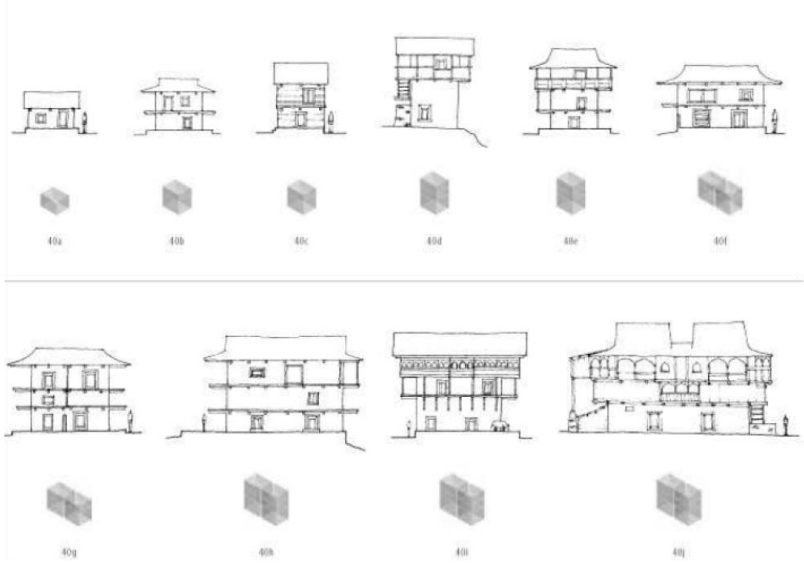


Fig 25: Story Unit in Kath Kuni (Matra, Jay Thakkar)

The broad categories of spaces in Kath Kuni are:

1. Panthang
2. Balcony
3. Gaushala
4. Bathroom
5. Plinth.

6.1.1.1 Transitional Spaces (Balcony, Stairs, Plinth)

Transitional spaces of kath kuni houses of Himachal Pradesh, such as plinths, balconies, and vertical connections, act as links between interior rooms and outside shared areas. These spaces exhibit variation in scale, articulation, and function, contributing to the unique identity of each house. Balconies, built entirely of wood, are the most diverse and integral transitional spaces in kath-khuni houses. They can be found on the first and second floors and vary in type and scale. Balconies serve as an intermediate zone between interior rooms and exterior spaces, regulating temperature and providing a second skin to the house. Traditional houses often have semi-covered or open balconies on the first floor, which serve multiple purposes, including transportation, laundry, sorting agricultural produce, and socializing. These balconies act as sunrooms, allowing people to enjoy the warmth of the sun while interacting with family and neighbors. They also function as spaces for food preparation, community meetings, discussions, and enjoying the sunset.

Fig 26 : Sitting area to baske in the sunlight and do household chores (Source: Matra).

Fig 24: Balcony as a Transitional Space

Fig 27: People overlooking a marriage procession through the balcony.

Fig 28,29,30: balcony

6.1.1.2 Multi purpose space (Panthang)

In the picturesque region of Kath-Kuni, the concept of spaces that serve multiple purposes is deeply ingrained in the architectural heritage.

One notable example is the "panthang," a space designed for various activities. It typically comprises a kitchen area with a stove "chullah," which radiates heat, effectively warming the indoor room temperature. The other part of the panthang features a bottom-sitting single mattress and a table, serving as a multifunctional living, dining, and sleeping space for the users. The design of the panthang eliminates the need for excessive navigation within the dwelling. Its integration of essential functionalities in a single area allows the residents to conserve energy and time, particularly when they have pressing outdoor responsibilities. During scorching summers, the panthang provides respite, while during chilly winters, it becomes a cozy sanctuary that eliminates the need for frequent excursions to other rooms.

Kath-Kuni architecture exemplifies the harmonious blend of tradition and practicality, showcasing how spaces can be optimized to cater to the specific needs of the residents. The multifunctional nature of the panthang is a testament to the ingenuity and foresight embedded in the design philosophy of this remarkable architectural style.

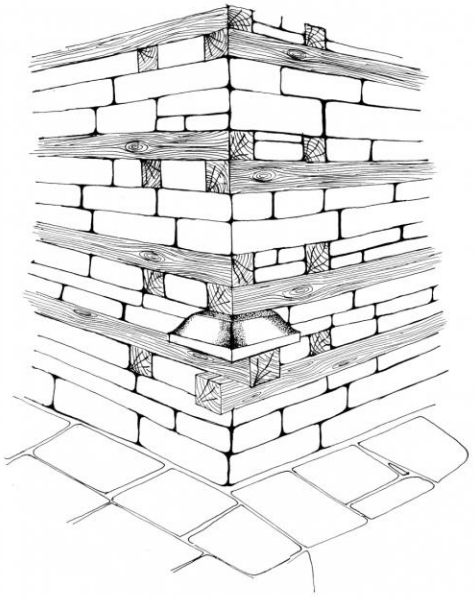
Fig 31 : Panthang is a traditional house.

Fig 32: Contemporary Translation of Panthang

6.1.1.3 Hybrid structure (Mixed Kath kuni)

According to Rahul Bushan the principle architect of architectural firm ‘The North’, this type of building can be categorized as the type where the aesthetics of the building appears similar to kath-kuni but it is actually the modern traditional frame structure building underneath.

The primary difference will be in how the wall of such a building is constructed.
For traditional kathkuni construction the walls have two layers of wall internal and external and the gap between them is filled by loose stone. It is a dry form of construction which does not need any mortar or binding agent.
On the other hand, hybrid construction is a frame type construction where the columns, beams and roof slab is constructed first, then the walls are constructed and is finished by cladding that appears and looks like kath-kuni style of architecture.



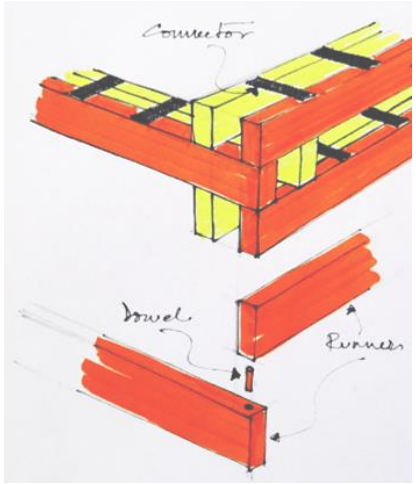
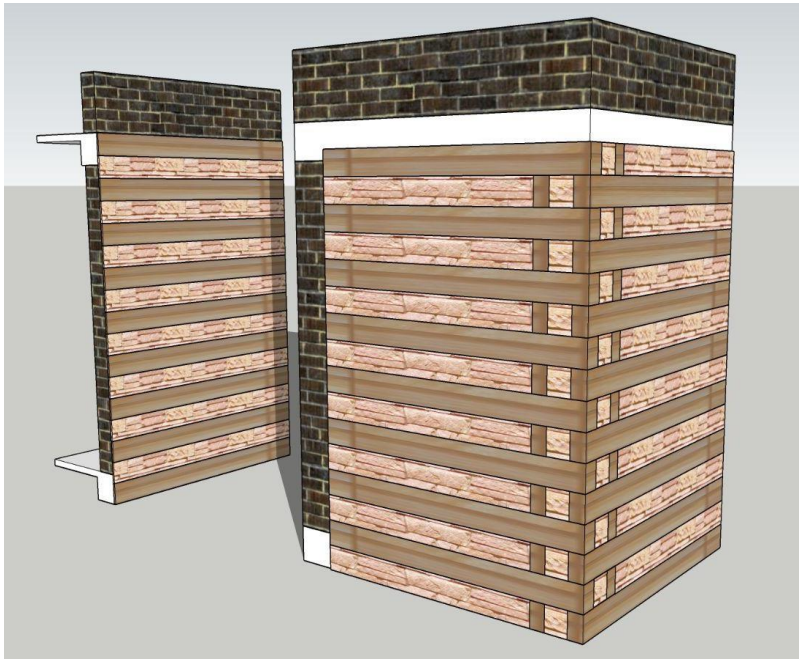


Fig 33 (source: sahapedia.org) & 34: Traditional Kath-kuni exterior and a sectional view

Fig 35: Traditional Kath-kuni exterior with mud plaster



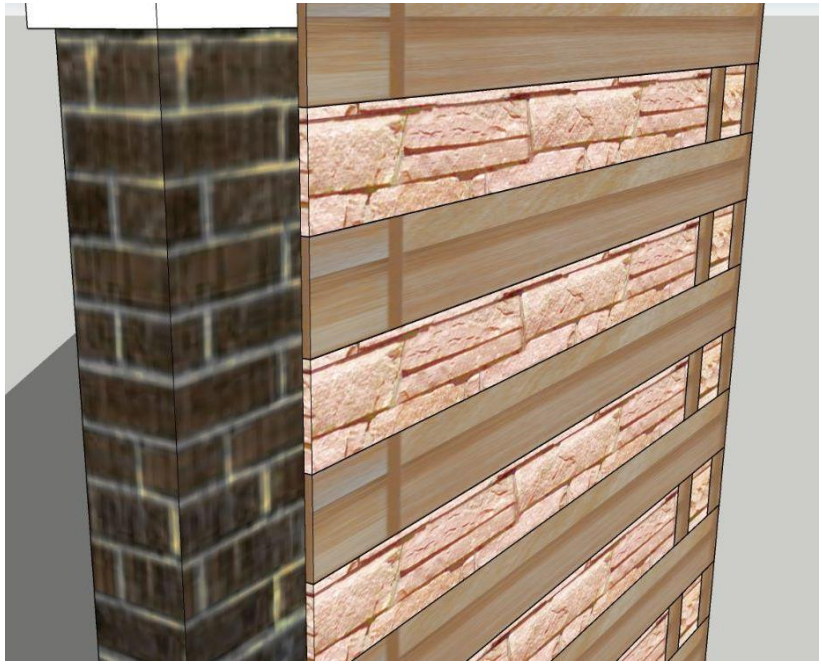


Fig 36, 37 Hybrid Kath-kuni wall laying pattern

6.1.1.4 Components (Wall)

The construction of Kath-Kuni walls follows a unique technique that showcases the mastery of traditional craftsmanship . The Kath-Kuni walls offer several advantages. Firstly, the wooden framework provides flexibility and stability, allowing the structure to withstand earthquakes and other natural forces. Secondly, the use of locally available stones makes the walls environmentally sustainable and harmoniously integrates them with the natural surroundings. Additionally, the combination of wood and stone results in excellent thermal insulation, keeping the interiors cool in summer and warm in winter.

The interlocking system enables flexible movement of walls during earthquakes, effectively absorbing the powerful seismic forces without damage. River stones fill the gaps in the wooden frame to enhance stability and resilience. Kath kuni structures feature double walls filled with stone, rubble, and hay, providing insulation. Mud plaster covers both the interior and exterior walls, ensuring excellent insulation. Slate tiles contribute to stability by exerting downward pressure on the entire structure.

Fig 37: Traditional Kath-kuni wall timber laying pattern

Fig 38:Traditional Kath-kuni wall laying pattern (source: sahapedia.org)

6.1.1.4 Components (Door)

The Kath Kuni door is crafted with precision using traditional techniques and materials. It seamlessly integrates with the Kath Kuni structure, reflecting its unique architectural style. The door is meticulously designed to provide durability, security, and aesthetic appeal, showcasing the craftsmanship of the local artisans. With its solid construction and attention to detail, the Kath Kuni door adds to the overall charm and authenticity of these traditional structures.

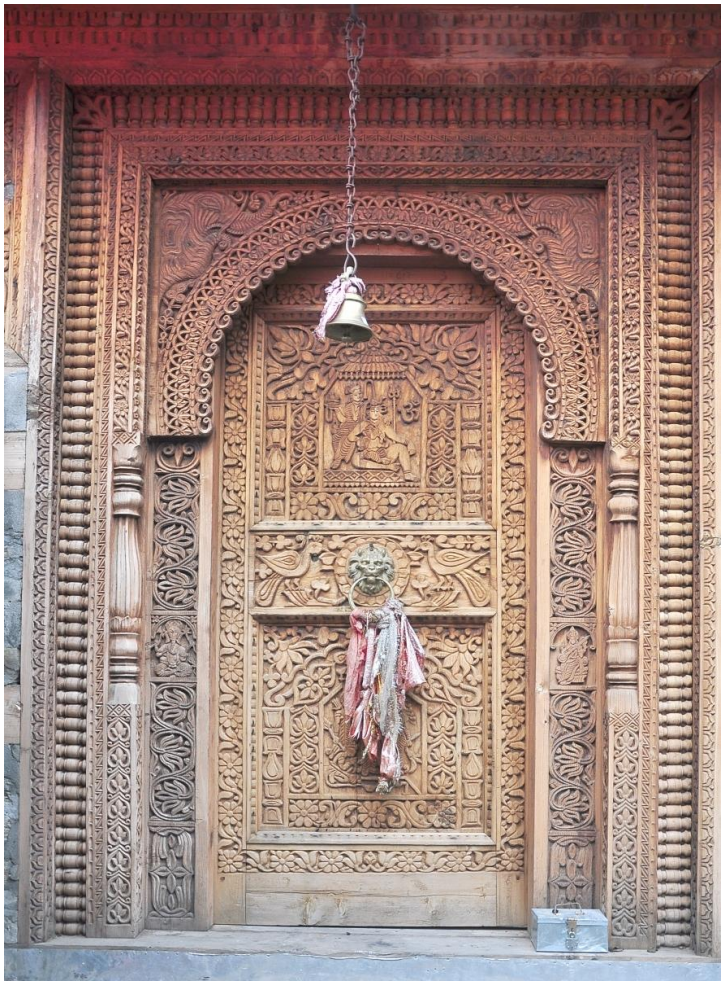


Fig 38 & 39: Skilled wood carving & ornamentation on traditional kath kuni wooden doors (source : saharapedia)

6.1.1.4 Components (Window)

The Kath Kuni window is a carefully crafted element of the traditional architectural style. They are generally very small in dimension. It harmoniously blends with the Kath Kuni structure, showcasing the skilled craftsmanship of local artisans. The window design incorporates traditional techniques and materials, offering both functionality and visual appeal. It allows natural light to filter in while maintaining privacy and ventilation. With its attention to detail and authentic character, the Kath Kuni window adds to the overall aesthetic and cultural significance of these structures.

Fig 38 & 39: Skilled wood carving & ornamentation on traditional kath kuni

Fig 40: Small window openings in Kath Kuni (source : saharapedia)

6.2 Building System of an Kath Kuni house form

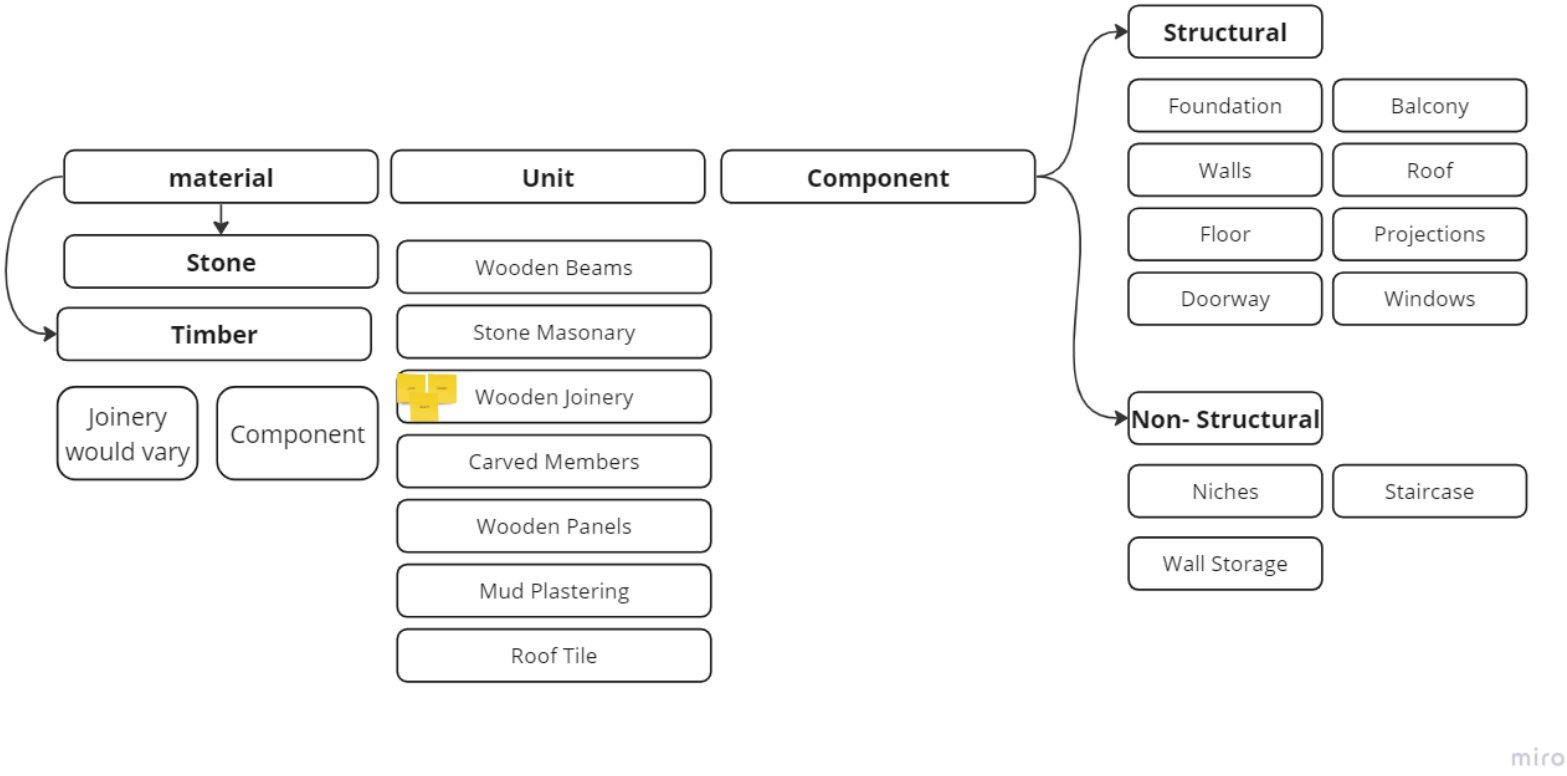


Fig 41: building system in Kath Kuni (credit: North)

6.3 Calculate Quantity of materials

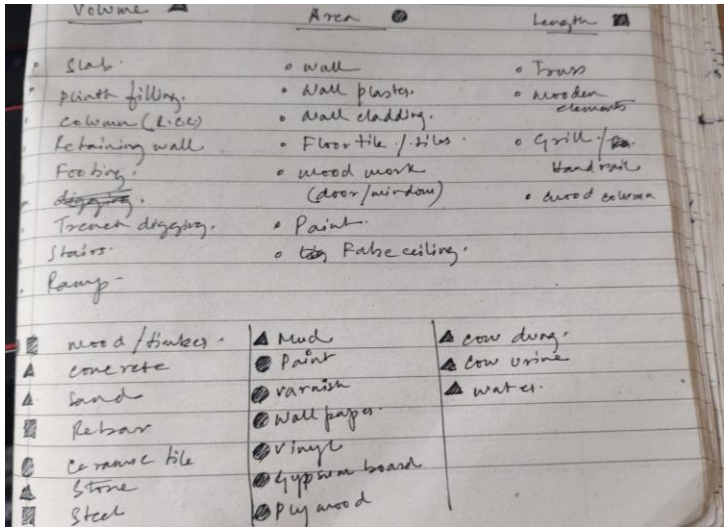


Fig 41 : Calculation of material quantity is possible by calculating the volume, area or length of different components. This technique can also be used for analysis of room ratio to wall size.

Square Feet of Area ÷ Coverage Rate = Quantity of Bags or Gallons

Kath Kuni , being a traditional architecture style does not follow contemporary standards. The materials, their dimensions & ratios would vary. Unlike bricks, cement, steel bars that have standardized dimensions and are tested on different parameters.

Hence a standard Brick wall that would be 250mm, the Kath Kuni wall will have dimensions in range. Rahul Bhushan, Principal Architect at North, provided insights on certain dimensions.

Ground floor ht: 2.5-2.8 m

Upper Floor: 2.7- 3 m

Kath kuni wall thickness: 45cm- 60 cm

Door opening 1.2-1.5 m

Stair width: 0.3-0.6 m

Balcony: .75- 1 m wide

The stones (gitti) also come in different qualities and volumes. It does work on the rule of thumb, and is dependent on the materials type and their properties. But there is a standardisation that is dependent on a range of dimensions rather than a fixed dimension.

Their team is currently doing research on documenting this across Himachal for different traditional architecture styles.

7. Understanding the Digital Tools

7.1 Revit

7.1.1 Structure of Revit interface

Ribbon Menu (1) - to allow an inexperienced user access the functions quickly and efficiently. By dividing them into activity areas and grouping functions within a tab, the user is supported in navigating to the desired functionality.

Properties panel (2) - This shows information about the work environment

Project browser (3) - Enables the user to quickly and easily access any particular drawing for reference and alteration

Control bar for 3D view (4) - It is a shortcut for frequently used view properties.

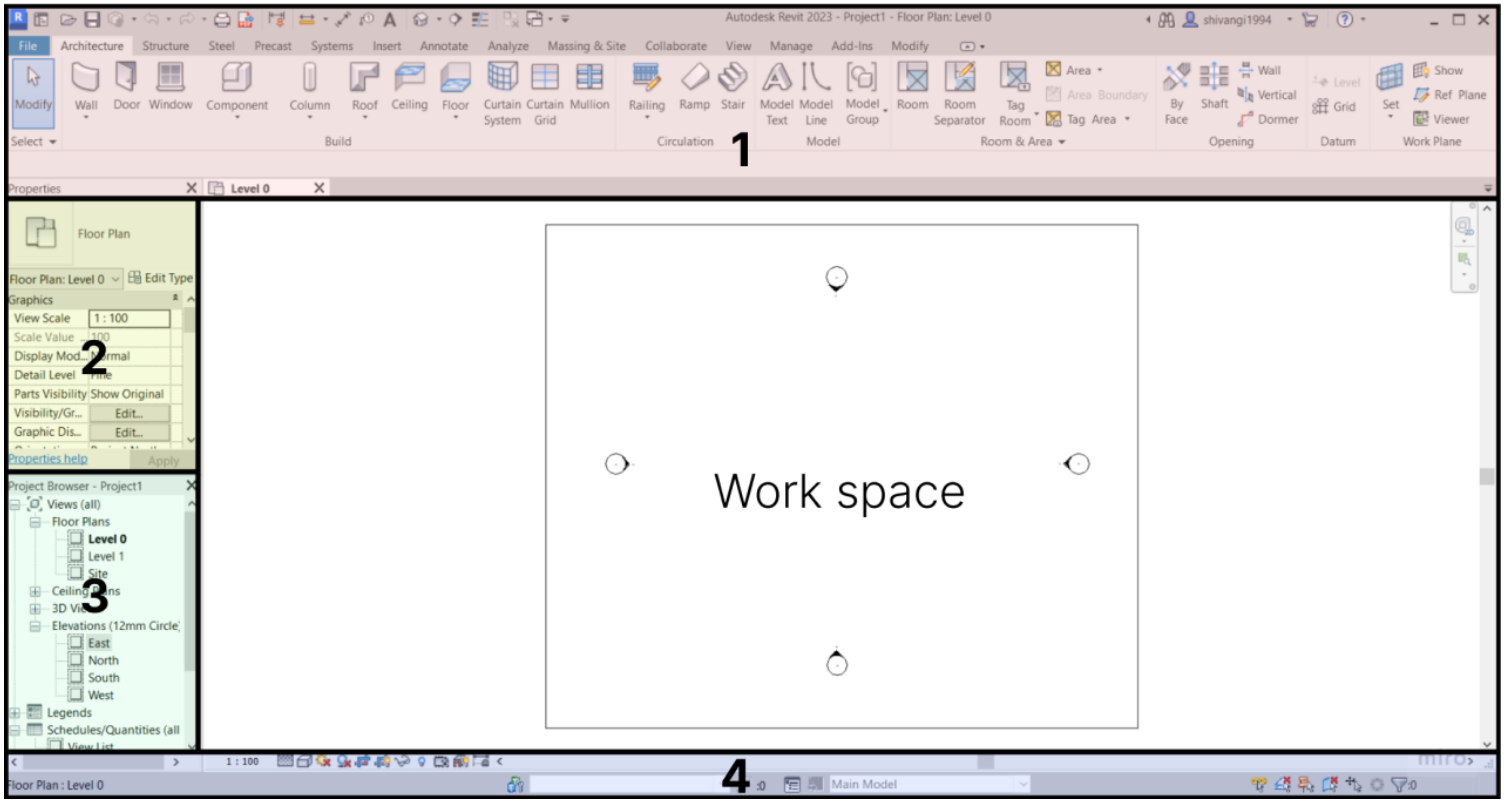


Fig 42: Revit Screen and categories

7.1.2 Understanding components in Revit

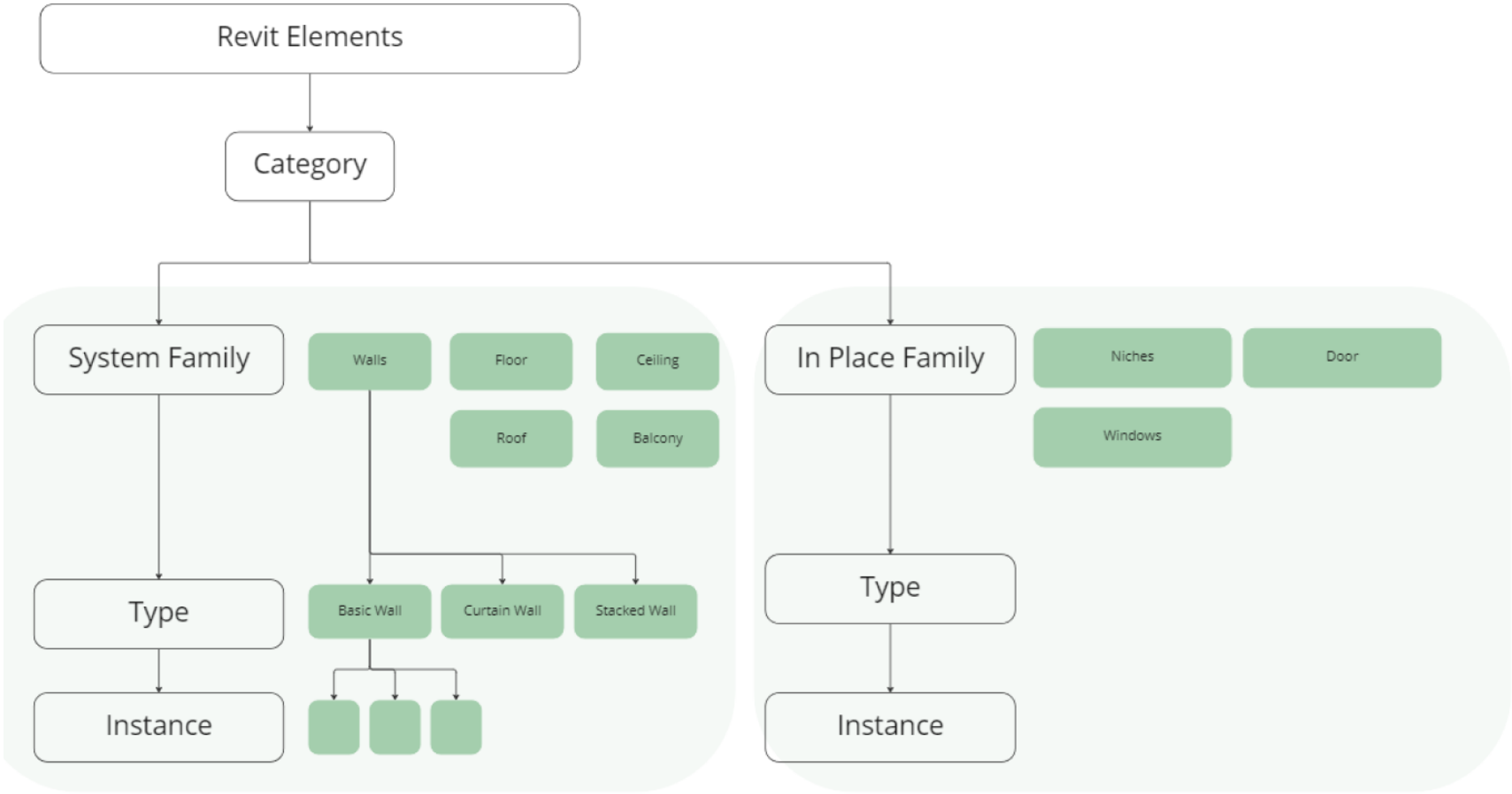


Fig 43: Revit Family Categorisation

7.1.3 Representation of Revit family

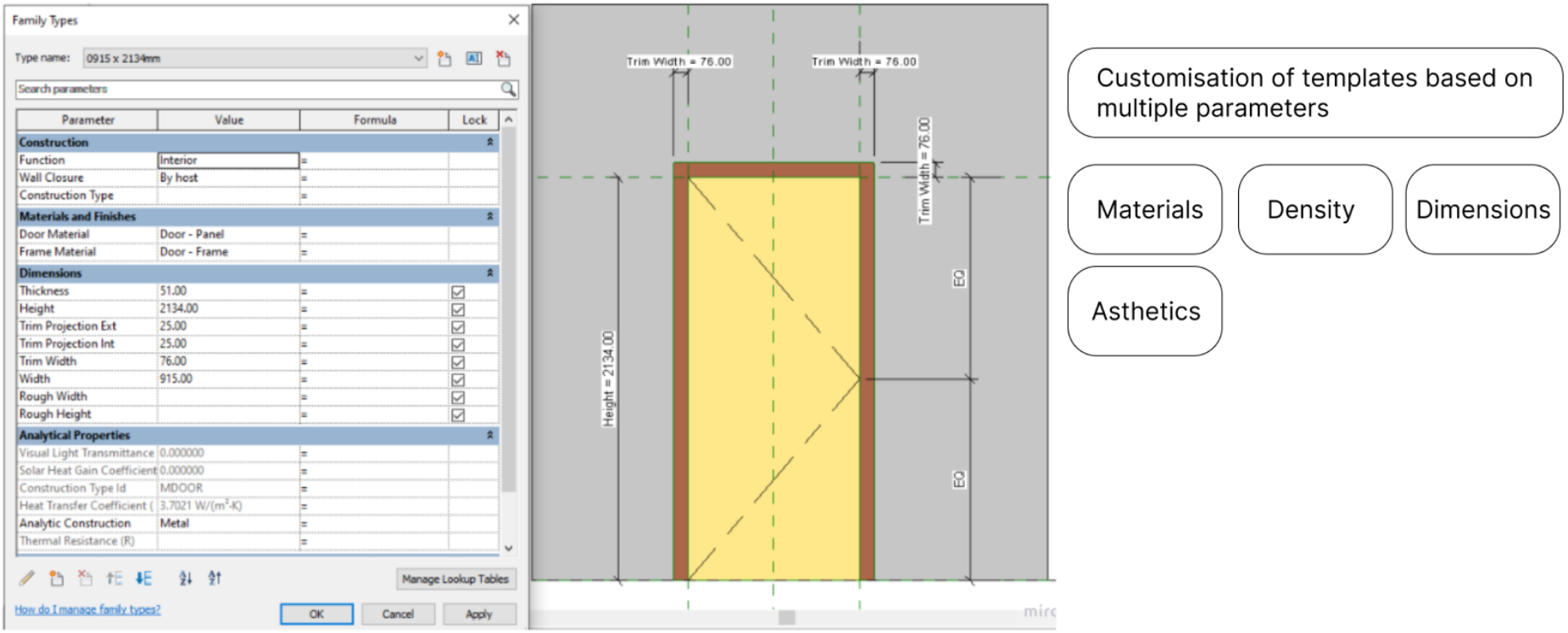


Fig 44: Revit Screen and categories

7.1.4 Computational design and plugin

Computational design uses algorithms and parameters to solve design problems using powerful computer processing. This dynamic and repeatable process enhances productivity and enables the exploration of numerous design options. In contrast, traditional design methods rely on the designer's knowledge and intuition within CAD programs, limiting the range of possibilities due to time and resource constraints. The computational design breaks down the design process into measurable steps, establishing instructions with identifiable patterns and trends. This serves as the foundation for algorithmic problem-solving in computational design.

Parametric design: Parametric design is a type of 3D modelling that uses rules and parameters to create and modify a design model.

Generative design: Generative design is a design process that uses algorithms to generate and optimize designs.

Algorithmic design: Algorithmic design is a field of computer science that deals with the development of algorithms for solving design problems.

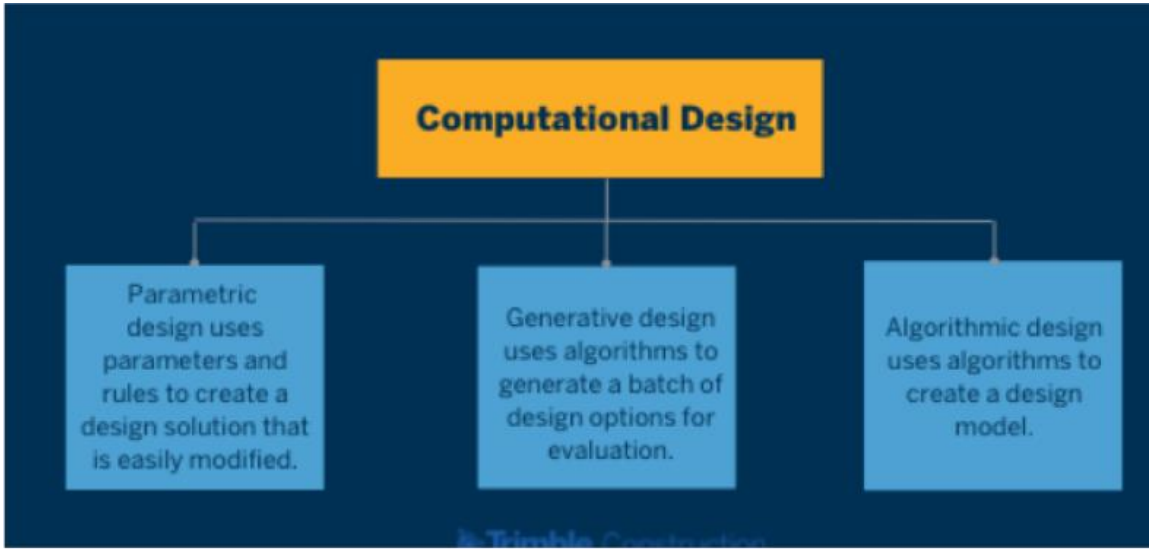
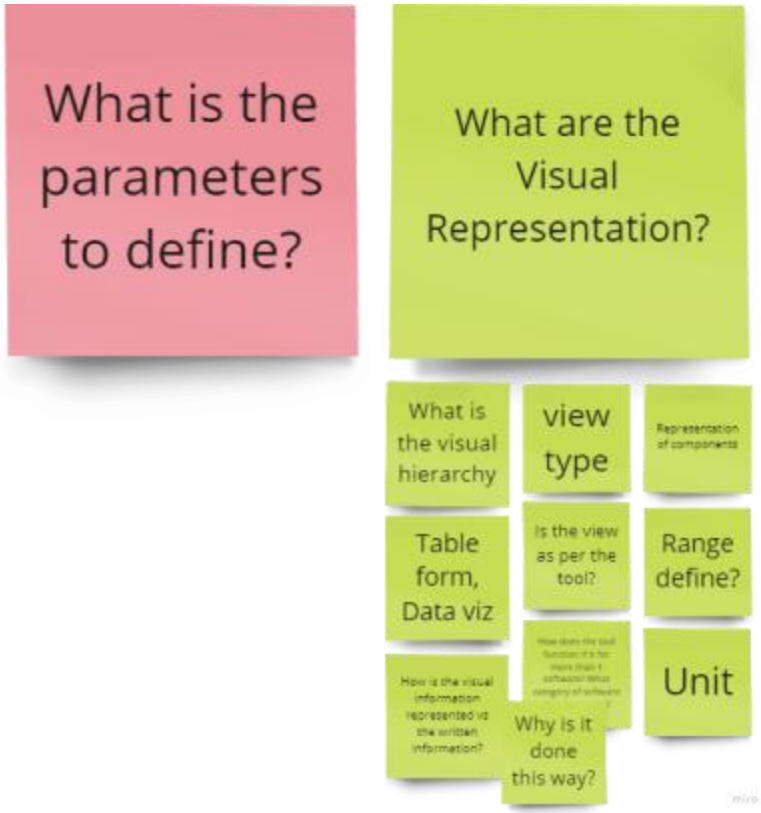


Fig 45: Types of Computational Design

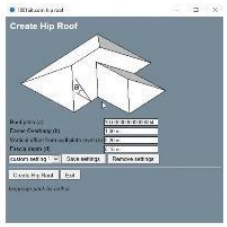
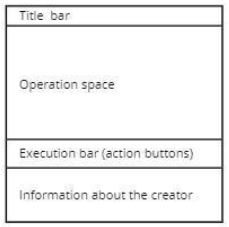
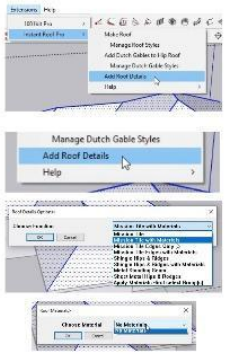
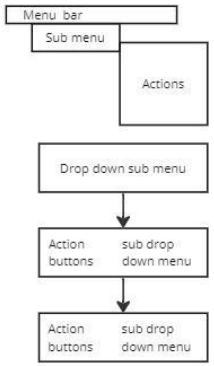
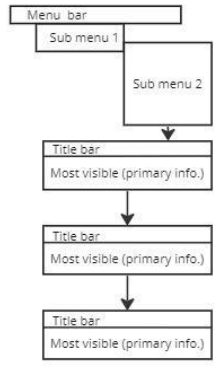
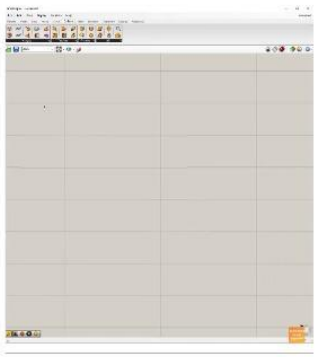
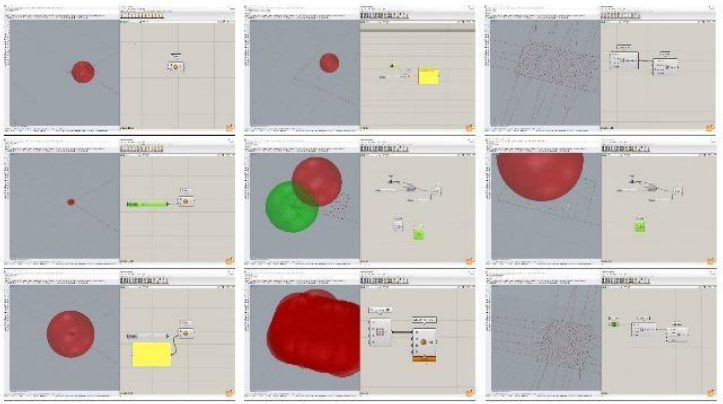
7.1.5 Understanding existing architectural plugins

Fig 46: Understanding Plugins



Generative design combines AI and human intuition to overcome the limitations of human design. AI creates hundreds of possible designs, while human designers refine the optimization criteria. Left to their own devices, designers tend to create predictable results. However, it is unfeasible for a human to produce and vet all possible design options. This can lead architects to lean on tried-and-true designs or those used on past projects, sometimes rather than the ideal option.

7.1.6 Plugin study

CREATE HIP ROOF (Sketchup plugin) This is a **massing** tool that creates a single type of roof This plugin appears as a button on the top most tool bar of the software	**(Single operation)** The purpose of the tool is to create a volume that is used for its visual representation both internal and external **GENERATIVE PLUGIN**	**Major components are the** 1. Title bar 2. Operations panel a. Representative image b. Parameters c. Future referance panel 3. Action panel 4. Creator detail			It is applicable in traditional architecture as a **Massing tool** to create a very basic visual representation of the users idea	The parameters that need to be defined manually are 1. Roof pitch - numeric value 2. Overhang - numeric value 3. Vertical ofset - numeric value 4. Fascia depth - numeric value	
INSTANT ROOF PRO (Sketchup plugin) This is a **massing** tool that creates roof details This plugin appears as a sub extension in the extension option in the menu bar	**(Multi operation)** The purpose of the tool is to create a volume that is used for its visual representation both internal and external **GENERATIVE PLUGIN**	**Major component is a** 1. Drop down menu a. Creating and managing roof style b. Adding details c. Help			It is applicable in traditional architecture as a **Massing tool** to create a very basic visual representation of the users idea	At this stage the user **does not need** to define any parameter. They only need to **select an action**	
GRASSHOPER (Rhino plugin) This is a **massing** tool that creates roof details This plugin appears as a sub extension in the extension option in the menu bar	**(Multi operation)** The purpose of the tool is primarily used **to build generative algorithms** **PARAMETRIC PLUGIN**	**Major components are the** 1. Title bar 2. Menu bar 3. Ribbon tab bar (component palettes) a. Ribbon b. Ribbon panel 4. Canvas toolbar 5. Canvas (Workspace) 6. Status bar					

7.1.7 Creating component in revit

There are 6-7 broad steps that are used to create a component in revit, other than this there are several sub steps. It is a very

tedious process.

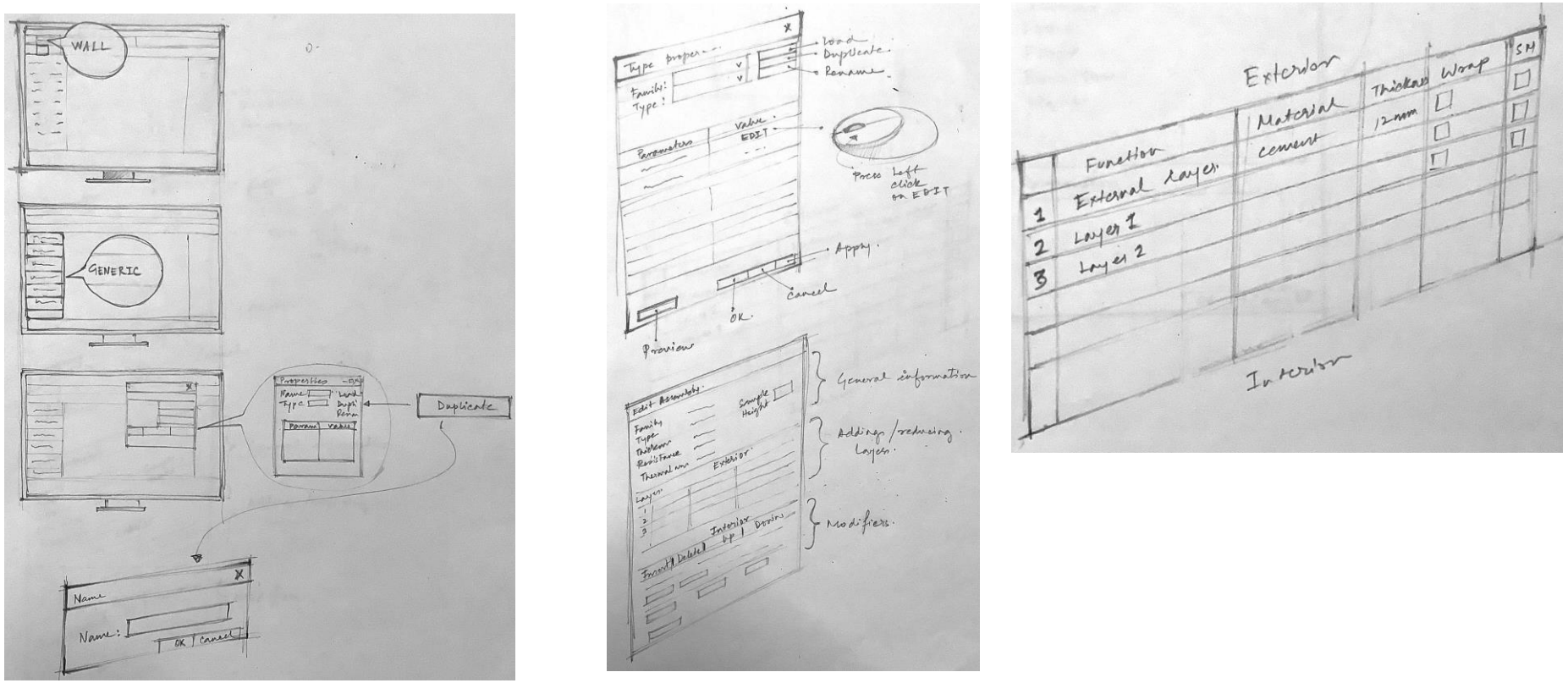


Fig 47: Creating Components is Revit is an extensive process currently.

7.1.8 User Flow of an architect on Revit

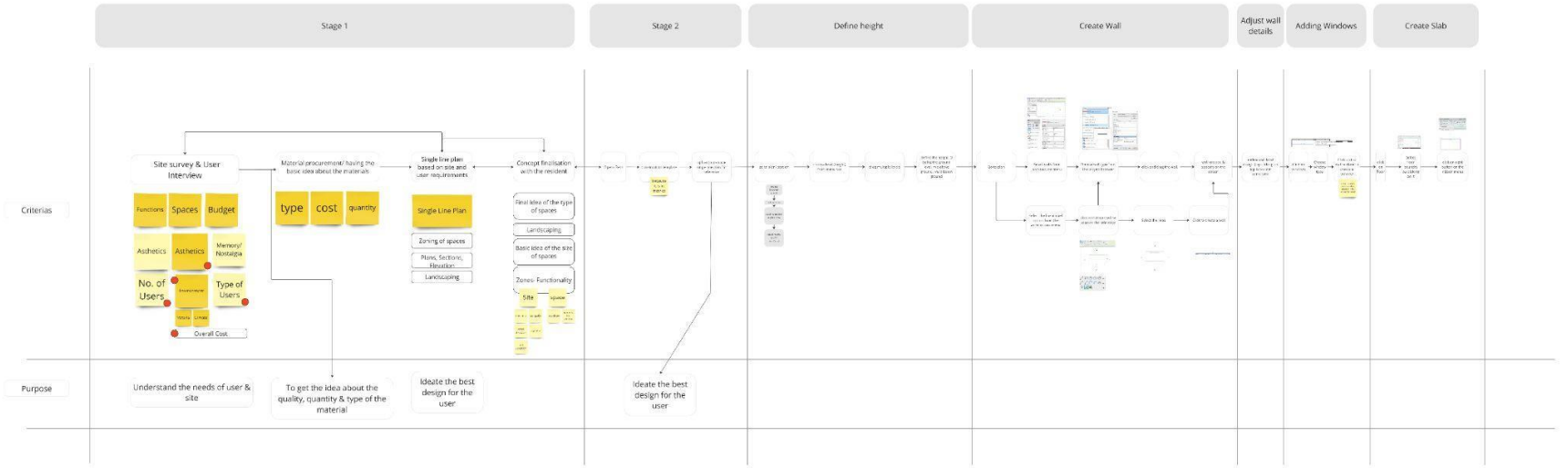


Fig 48 :Scenario: 3 Users were asked to add a Wall, door & Slab on Revit & their flow was noted to understand their flow on Revit.

7.1.9 Why a BIM software

Building Information Modeling (BIM) software refers to a range of computer programs and tools designed to facilitate the creation, management, and analysis of digital building models and related information.

Hence a similar software or a plugin for such a software will,

1. Enable architects to accurately analyze and design
2. Provide the necessary information need on the site for execution
3. Allow parallel creation of executable drawings and details

Since there are no dedicated BIM software or plugins for kath kuni architecture, so a plugin that can be used as part of Revit will help in the easy and efficient creation of kath kuni concepts.

8. Revised Objectives

8.1 Objectives

1. To design an independent plugin system that enables users to incorporate traditional design components, in 2D & 3D architectural design.
2. To create a repository that assists architects with the relevant and validated details about the traditional style of architecture.

8.2 Scope

1. For the scope of this project Traditional Kath Kuni Design of Himachal Pradesh has been considered. Context of Revit as the BIM software in which the plugin will work.
2. The user is an architect. It focuses on Novice architects in Kath Kuni Design.
3. Scope of Plugin
    - The plugin is developed for Kath Kuni style of architecture. Although, in future, it could be used as an example to develop plugins specific to Different kinds of Traditional Architecture across India.
    - Focuses on Walls Doors & Spaces in Kath Kuni.
    - The Plugin only intervenes in Design, Space Analysis and Drafting Stages.
4. Scope of the Website:

    - Although the website will act as a repository for all styles of traditional architecture in India. Currently, the details of Kath Khuni Architecture have been uploaded.
    - The focus of the website currently is on Kath Kuni Information, Relevant Component & Case Studies.

9. Ideation

9.1 Scenario

Raghav, is an architect based out of Kullu. One of his clients wants an authentic kath-kuni structure but he is not so well acquainted with this style of design.

He knows the basic zoning of the house. He plans to use a BIM software like Revit to create a 2D floor plan and 3D model using Kath-Kuni components such as walls, doors, windows, and slabs, to accurately visualize the design.

9.2 Ideation 1

Idea (a) - Updating Existing Component Family & Material Library for Revit.

Creating Kath- Kuni Components Family and Update the Component Library. It would be an In Place Family in Revit.

Steps:

- User downloads & installs the Traditional material library
- User creates an standard Brick wall from existing revit template
- User creates an RCC Wall
- defines the sill & the lintel level
- Clicks on window in the architecture menu
- Chooses kath kuni window family from multiple options
- Places the window on the wall plan
- Customise the properties of the window

-

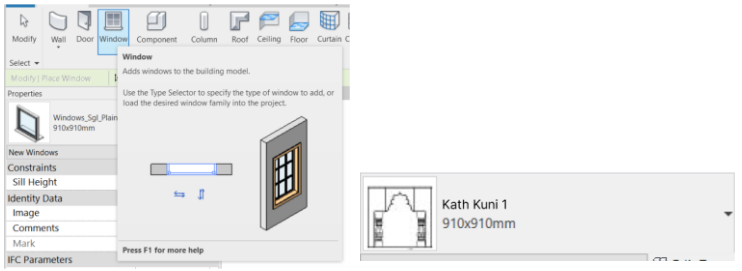


Fig 49 : Ideation 1 Updating Kath Kuni Components in existing Revit Family

Why it did not work:

1. Revit's library focuses on standardized components that are commonly used in contemporary construction practices. Since the dimensions of Traditional Architecture are in a range, hence it is not standardised in Revit. Possible to do that in Revit.
2. For a Novice architect who is not familiar with Kath Kuni Practice, they might need more information in order to understand and edit a component.

Idea (b) - Separate Component & Material Library Plugin

Steps:

- Clicks on the plugin in the architecture menu
- Selects the family
- Places it on the wall
- Edit the properties of the family

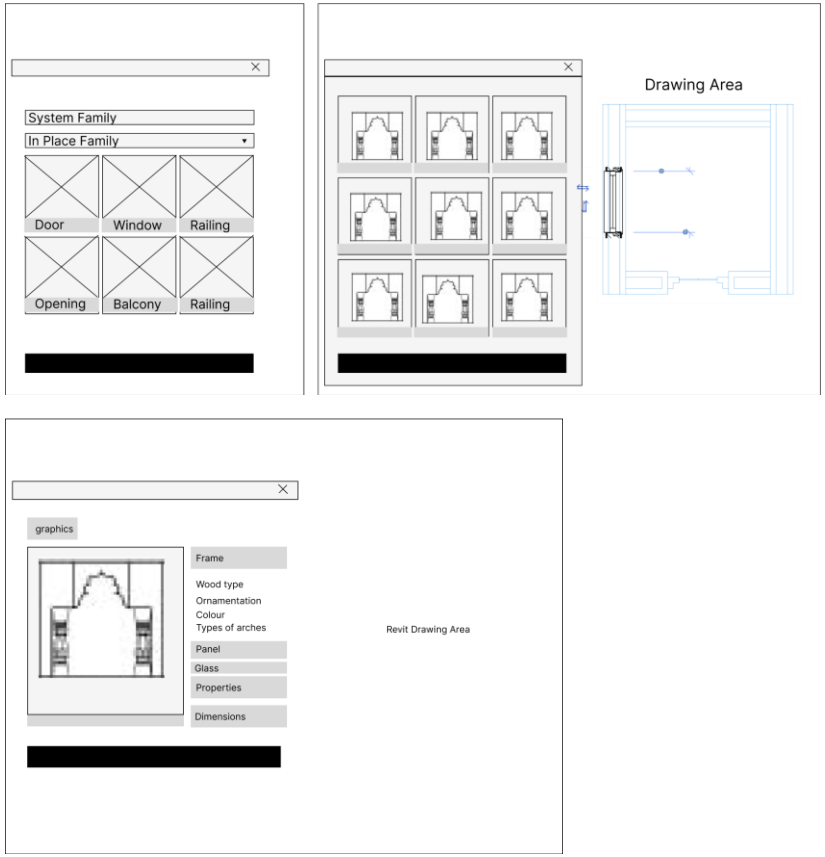
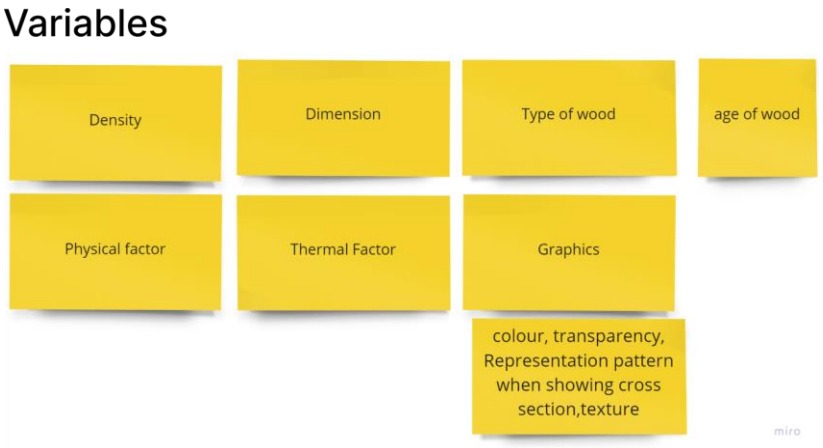


Fig 50 : Ideation 1 (b) A plugin for kath kuni components & materials



Learning:

- Separate Plugin could work because it has the opportunity to design it as per the needs of the user and style of architecture

9.3 Ideation 2

Kath Kuni Architecture Plugin for Revit

The Plugin would be an extension to Revit. It followed the existing flow of an architect in Revit. It comes into play after the Single line plan is hand drawn(Conceptually drafted) by the architect. It also takes into account the overall architects process. It currently focuses on the ideation and drafting aspect of the Process. Here, the architect is adding a wall, door & slab.

The Plugin is acting as an assistant to the architect. It is that team member who is an expert in Kath Kuni style of architecture and is here to provide the architect with the relevant information and suggestions that would assist them in making a design decision. It follows the principles of generative design, to assist the architect.

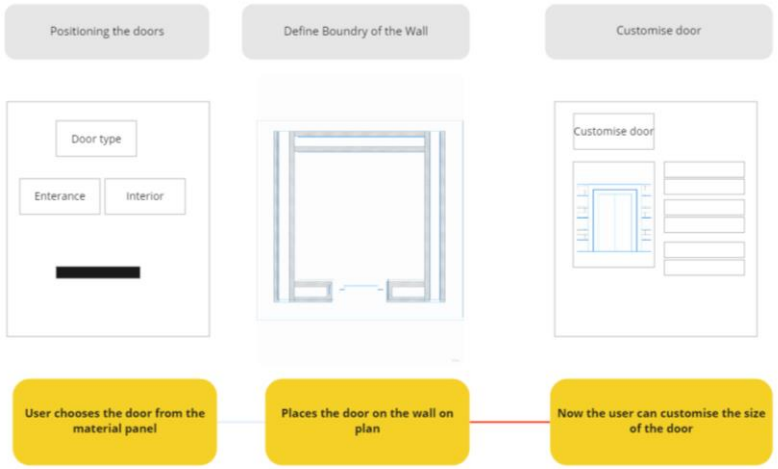


Fig 51 :Flow of Kath Kuni Architecture Plugin

Learning:

- Since the architect's process is not linear, and they are Novice in Kath Kuni, they would need multiple kinds of information to make a decision. Hence this needs to be more detailed.
- It is also important to understand the feasibility of suggestions. Research was needed on that.

10. Final Design

Website Prototype:
https://www.figma.com/proto/P4yXXRFrG22C3wNkZa1VfA/Shivu-final?page-id=0%3A1&type=design&node-id=1-2682&viewport=1170%2C220%2C0.1&scaling=scale-down-width&starting-point-node-id=1%3A2682

Plugin Prototype:
https://www.figma.com/proto/PRKwZ5eKNeEy4QeoaGtZzN/Kath-Kuni-Prototype?type=design&node-id=784-10376&scaling=scale-down&page-id=784%3A8838&starting-point-node-id=784%3A10376&show-proto-sidebar=1

For the Final Design, Kath Kuni Plugin for Revit was selected. The Traditional Design Plugin is a specialized tool designed for professional architects working with the traditional architectural style. The plugin acts within the Building Information Modeling (BIM) software enabling architects to incorporate Kath Kuni Plugin components and design principles into their projects. For the scope of this project Traditional Kath Kuni Design of Himachal Pradesh has been considered. Context of Revit as the BIM software in which the plugin will work. The plugin caters to both novice architects who are unfamiliar with Kath-kuni design and expert architects who want to streamline their design process. It is intended for architecture professionals who have a specific interest in traditional architecture and wish to integrate Kath-kuni elements into their projects.

The Kath Kuni Design Plugin focuses on the research, design, and communication stage of an architect's journey.

The overall benefits are as follows.

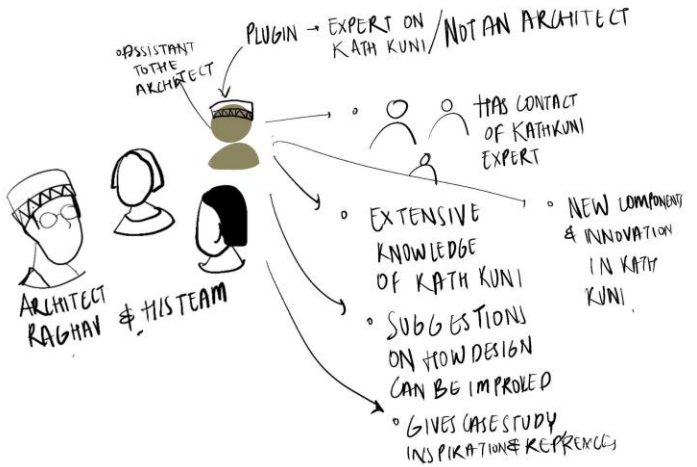


Fig 52 : Plugin acts as an assistant for the Architect, It is an expert in Kath Kuni Architect. It provides architect with the relevant details, resources and suggestions regarding Kath Kuni Architecture

- Access to a comprehensive component library of Kath-kuni design elements.
- Opportunities to modify existing components or create new ones.
- Understanding of spatial organization, construction techniques, material selection, material treatment, and traditional standards in Kath-Kuni design.
- Guidance on how to create authentic traditional designs while adhering to Kath-kuni principles.

- The plugin offers analysis and recommendations based on traditional Kath Kuni principles, covering parameters such as insulation, structural stability, seismic load, and climate responsiveness. By leveraging examples from traditional and contemporary architecture, the plugin assists architects in incorporating Kath Kuni elements into their designs.

10.1 Iteration-1

In this step, I analyzed the information architects need for design decisions in Revit. Collaborating with two architects, we identified the information used when adding, editing, and viewing properties of components in Revit's library. To create clusters and understand their value, we eliminated standard-based information not applicable to traditional architecture. This approach recognizes the need to tailor design tools like Revit for vernacular architecture. By prioritizing relevant information and design considerations, architects can effectively use software and create components that align with the intricacies of vernacular architecture. The user is a Novice Architect.

An information architecture was then created based on the parameters and the scenario.

Fig 53 : Information Architecture Initial Design.

What does the user want to achieve?

1. Adding the relevant Kath-kuni style components in plan (adding a wall).
2. He wants to view the properties of the component (property panel of the wall)
3. He wants to create a design and implement it on site (digital/ print form of the joints)

Create Wall

1. Collect Parameters.

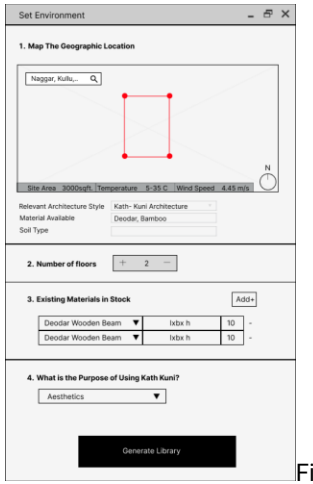


Fig 54 : Set Environment

2. Select Component & View Properties of the Component

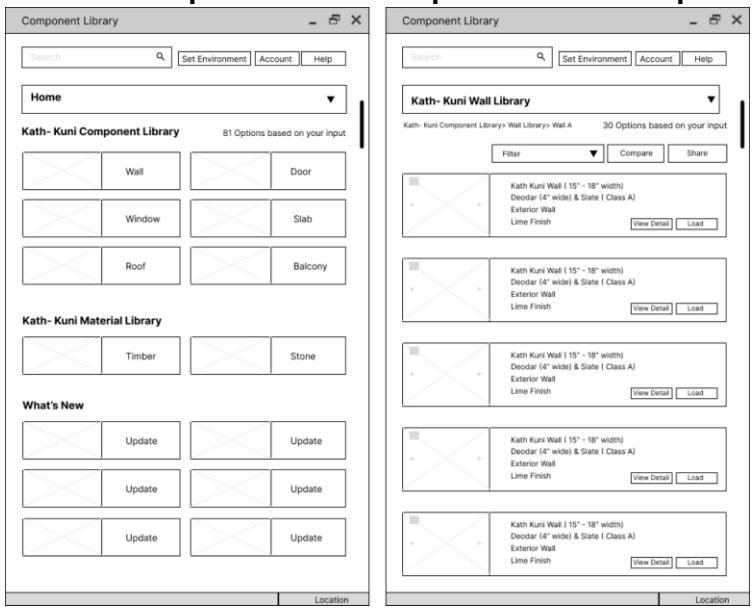


Fig 55 : Plugin home screen and view properties

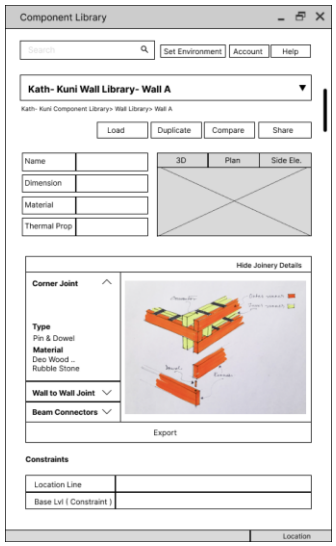


Fig 56 : Component Properties Screen

3. Goal : Viewing the properties of the materials

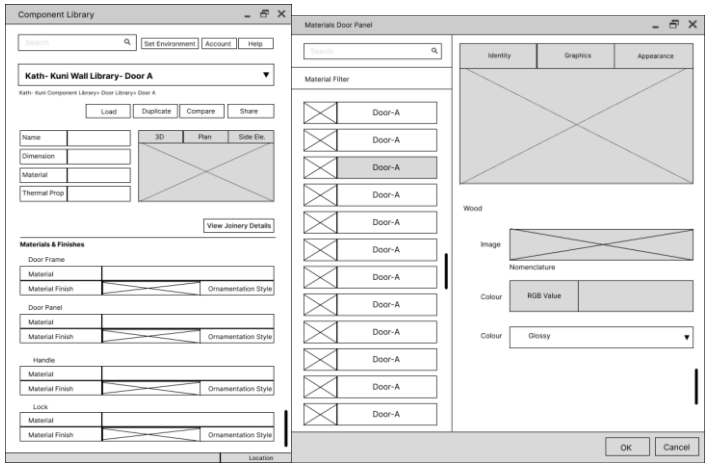


Fig 56 : Component Properties Screen

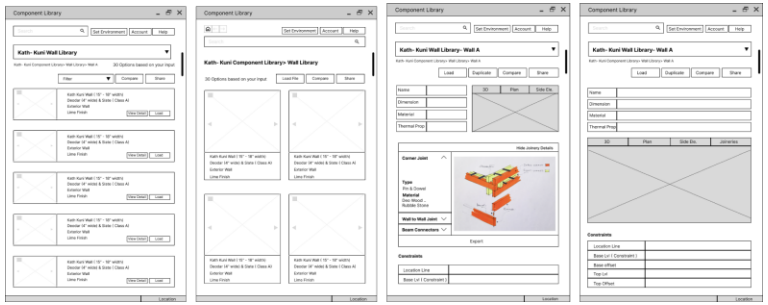


Fig 57 : Other UI options for screen properties

Learnings :

- Some technical information still did not make sense. More parameters need to be eliminated.

10.2 Final Iteration

1. Iteration 2
https://www.figma.com/proto/PRKwZ5eKNeEy4QeoaGtZzN/Kath-Kuni-Prototype?type=design&node-id=497-5418&scaling=min-zoom&page-id=142%3A10&starting-point-node-id=497%3A5418

10.2.1 Information Architecture of Plugin

1. Set Environment:
   The information here would be collected from the architect. The parameters would assist the plugin to suggest relevant information to the architect.
2. Kath Kuni Component Library:
   Consists of the basic components in Kath Kuni Design. Based on the information provided by the user. A list of Components are suggested based on the most to least relevant.
3. Kath Kuni Information Page:
   This would assist the architects to find the relevant information in Kath Kuni Design. It redirects to a separate website about Traditional Architecture in India to their Kath Kuni Information Page.
4. Kath Kuni Materials:
   MaterialLibrary of Kath Kuni is Listed. The users can edit materials. This would assist the architect to properly conduct analysis post modeling, and generate efficient Renders.
5. Kath Kuni Analysis: Would Analyse spaces in design, based of the function of space and the desired parameters

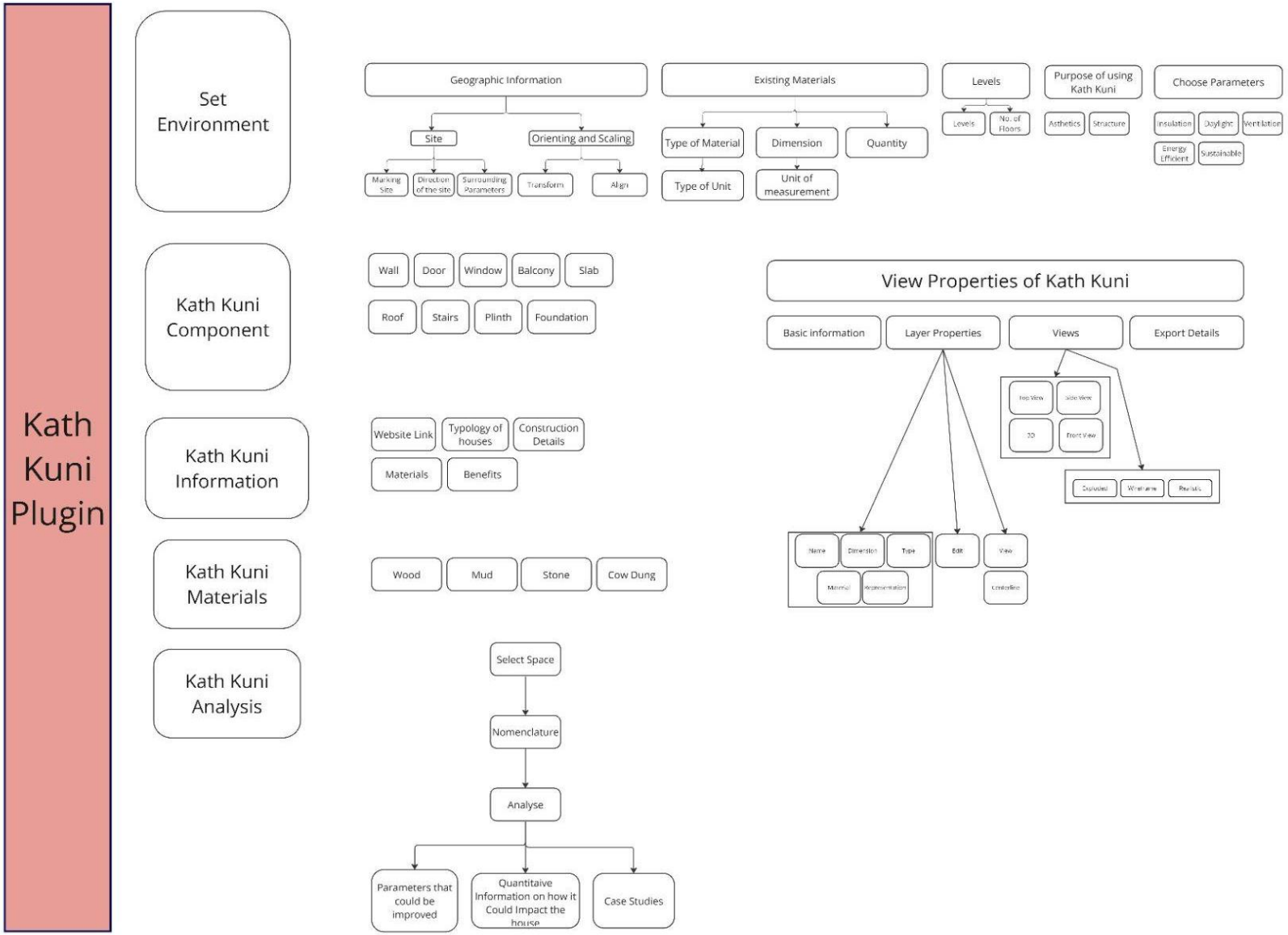


Fig 58 : Plugin Information Architecture

10.2.1 Flow Diagram

Raghav Wants to Create a Wall. He is done with client meet, site visit & analysis, & has prepared a single line plan with space allocation according to the conventional design.

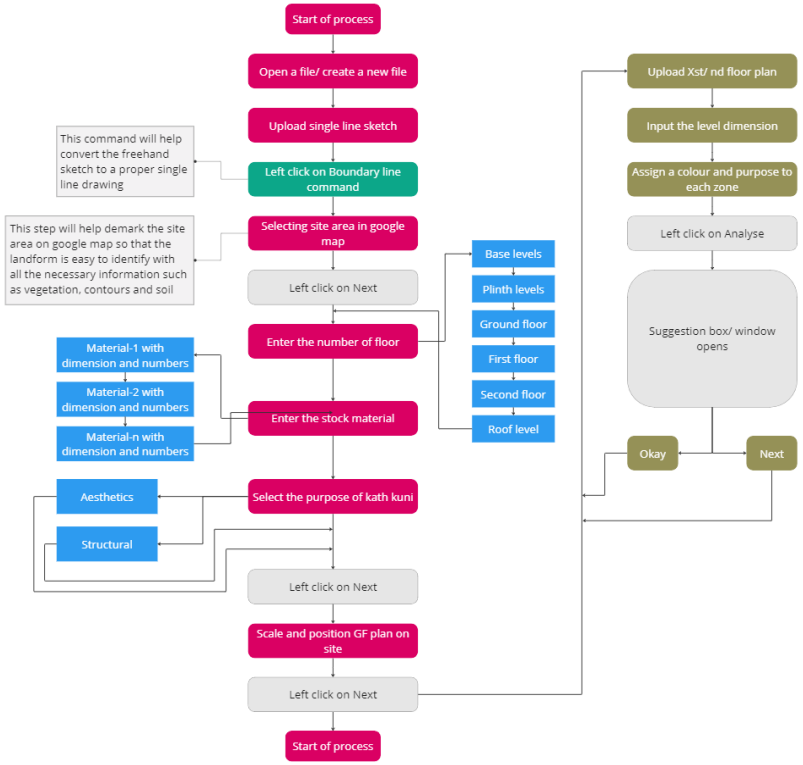


Fig 59 : Flow: Set Environment

Stage 1 Analysis:

- Just like an architect collects information from the client, Revit also collects information from the client in order to assist them better.
- This is feasible using “generative design”. Relevant suggestions are provided to the user through this.

1. Set Environment:

a) Geographic Information:

Since Traditional Design is Site Based, it becomes important to consider those Parameters. The Variables could be site contours, Navigation, Sunpath, Wind Direction, Climate, locally available materials and culture of the surrounding environment.

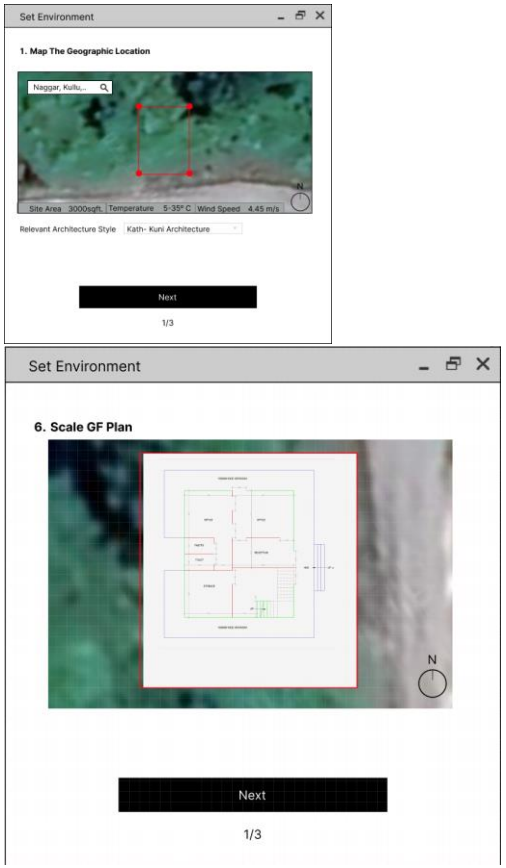


Fig 60 : Set Environment

Orienting a single line/ double line plan on the site would help in accessing the optimum conditions to create a comfortable experience for the user.
The suggestions could be with respect to spaces and openings.

b) Existing Materials:

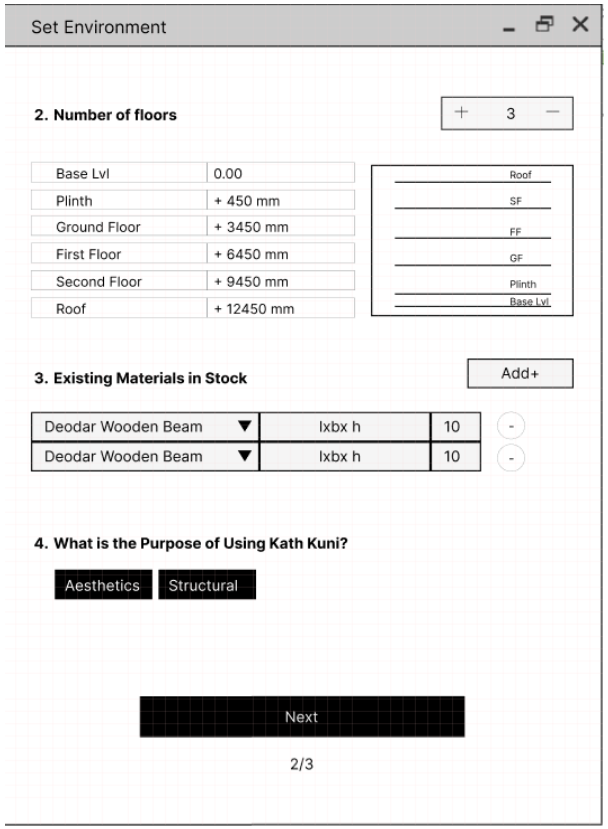


Fig 61 & 62 :Set Environment

Kath Kuni being a drywall, lego like construction, could be reused. Since these materials can be repurposed, architects could also collect materials during the information gathering phase. The suggestions for components from the library could be arranged accordingly.

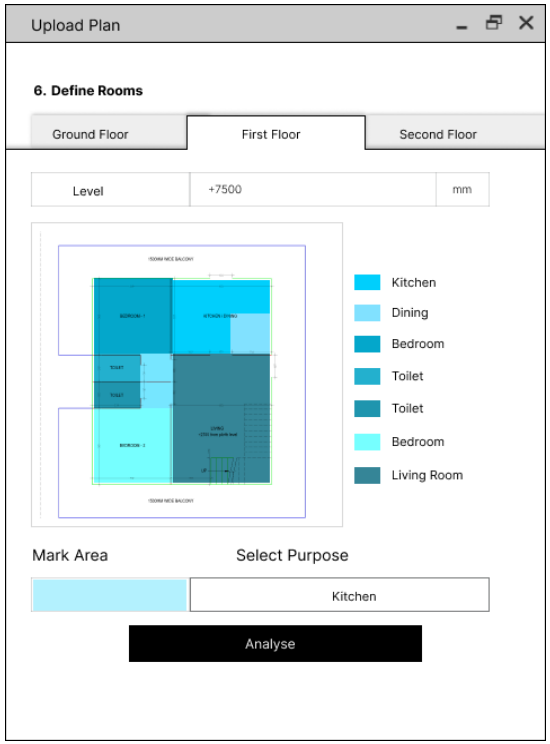


Fig 63: Set Environment

c) Levels:
Typology of Kath Kuni wall is Load bearing. Hence the number of floors is limited in Kath Kuni. If the user wants to go G+3, contemporary materials or design techniques need to be incorporated, so relevant components would be suggested to the client.

d) Purpose of Kath Kuni:

Asthetic: Some clients only want Kath Kuni to cater the aesthetics and selected parameters. It basically lets the plugin know if the client is looking for a hybrid design or not. It is widely noticed in hotels/ Resorts.

Structure: Includes an authentic Kath Kuni design with load-bearing walls and traditional materials.

e) Choose Parameters:
Allows the plugin to suggest options based on the ambient parameters that can be offered by a sustainable structure like Insulation, Daylight, Ventilation, and Energy Efficiency.

Stage 2 : Add and Edit Walls

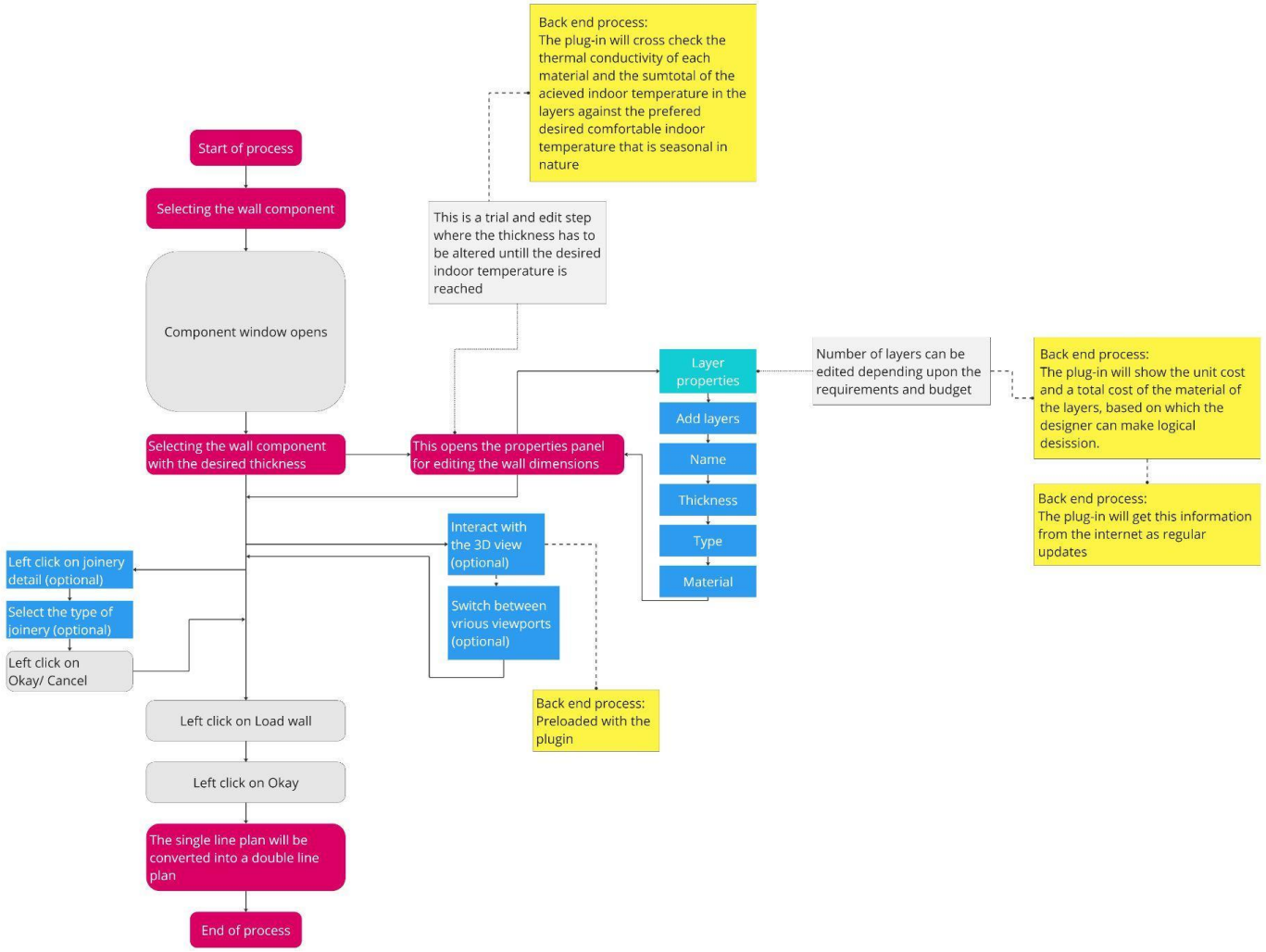
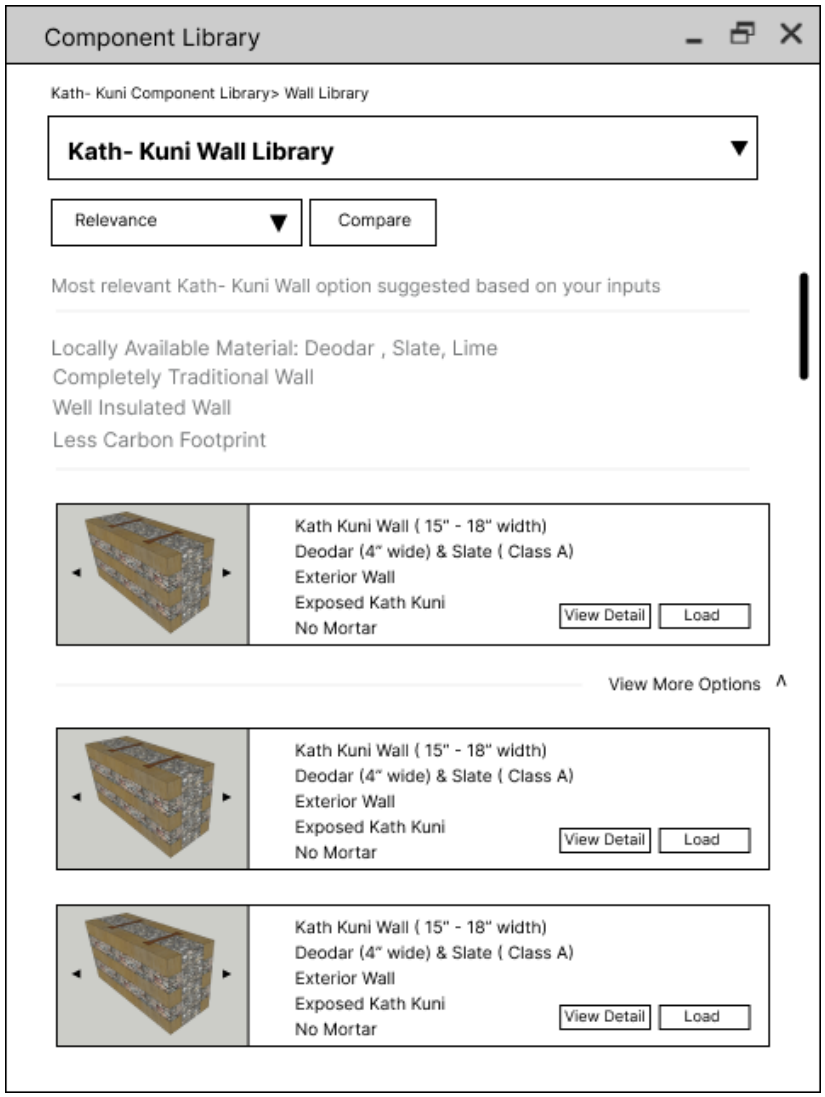


Fig 64 : Flow: Add & Edit wall



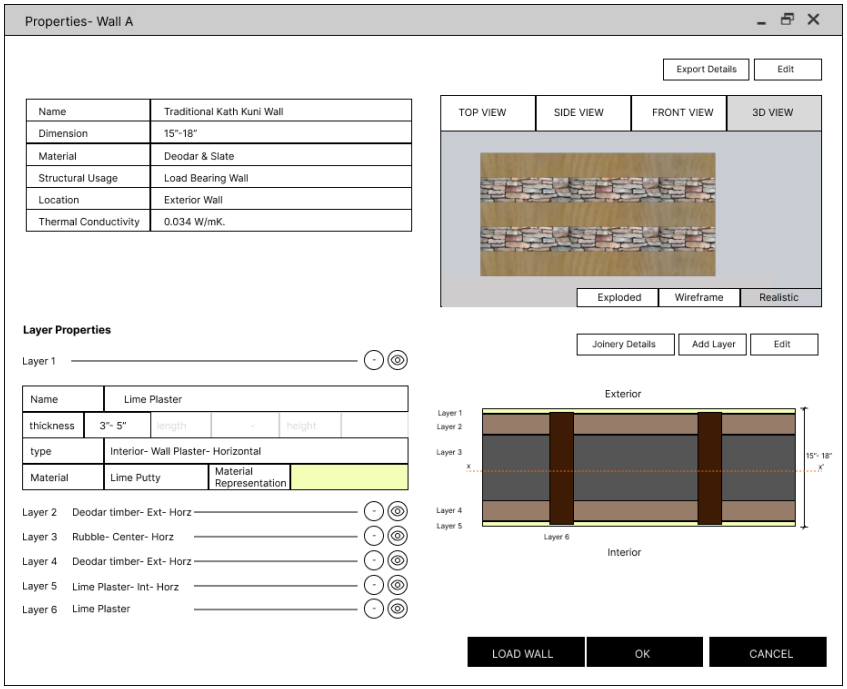


Fig 65 : Add & Edit wall

Stage 3 Add Windows

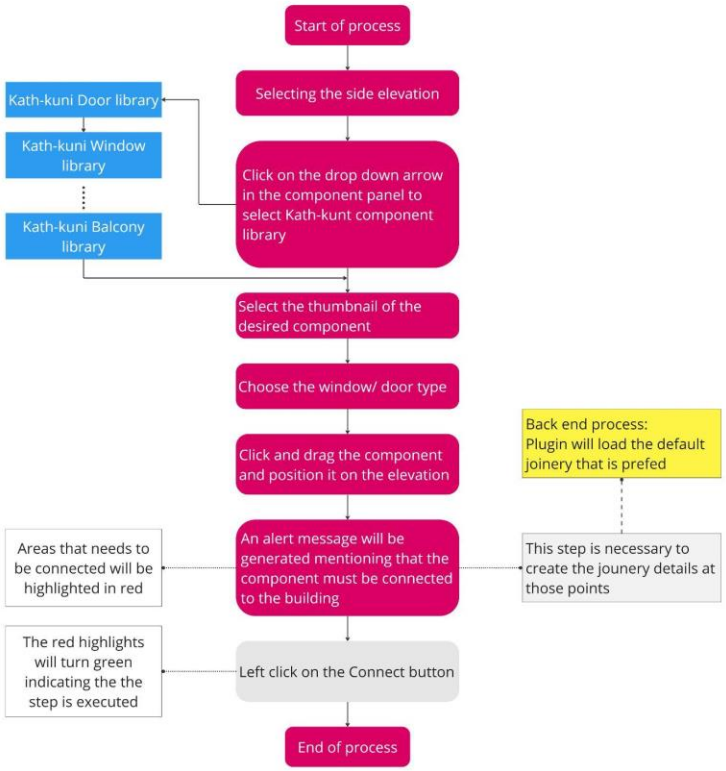
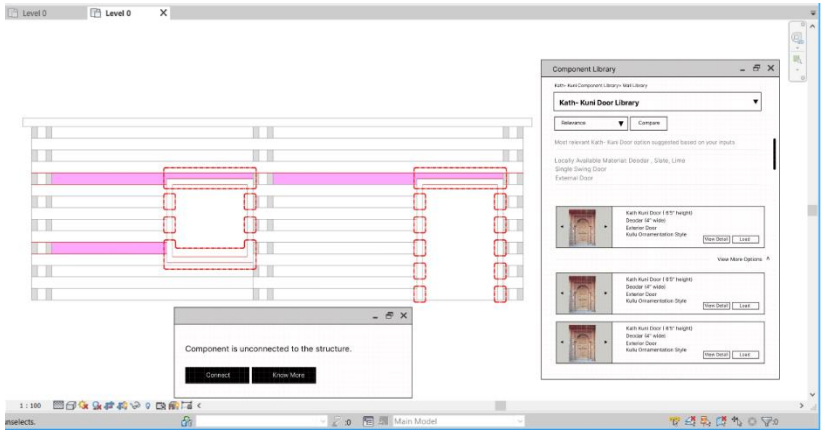


Fig 66 : Flow: Add Window



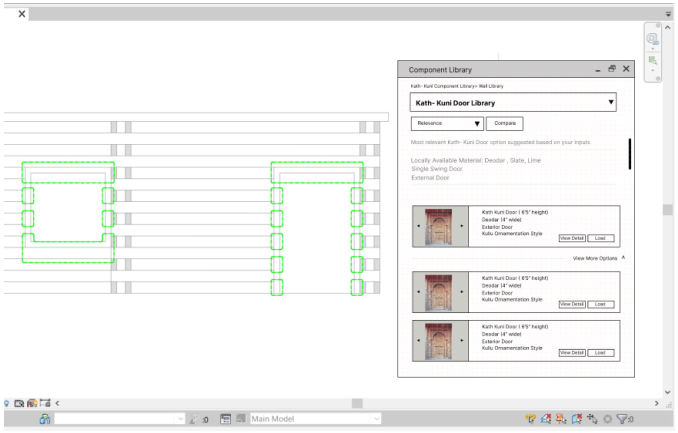
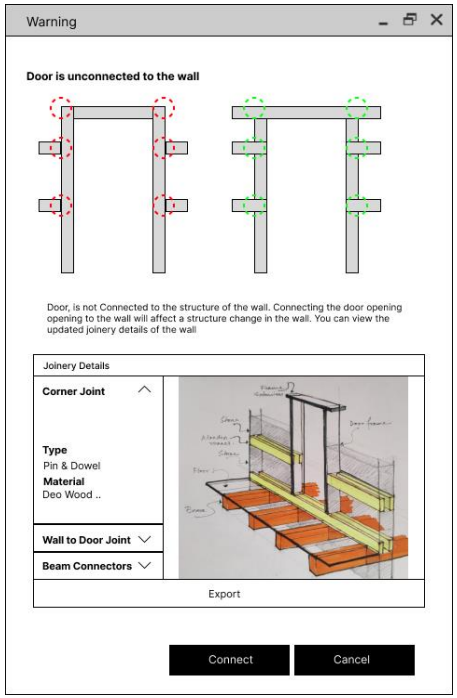


Fig 67 : Add Window



Notifications Errors & Confirmation

The purpose of notifications & error messages is to inform the user about the possibility change. It is also to inform the user about what is happening, what they are doing incorrectly and why is it incorrect. There could be multiple scenarios in which this could happen.

Cases:

1. Adding openings to the load bearing walls which brings structural change.
2. In case of someone replacing a double line brick wall with contemporary components with a thick load bearing wall or a thick wooden frame opening to a thin wall.
3. If the components are unconnected.
4. If the dimensions of the wall are making the size really small.
5. Orientation of components

10.3 Indian Traditional Architecture Website

The website was primarily designed to cater the feedback from the user that they need a preliminary source of information before adding the component. They also needed a trusted and reliant source of information. During my research I could find scattered & trusted sources of information especially when it comes to Traditional architecture. Also there is new work with respect to hybrid architecture happening everyday by different people.This information can be added to a repository. The new components that these users make can be published on the website, hence a component library.

Who will update the information and how can we ensure that the information is verified?

Architects, Structural & Civil Engineers, Builders, Professors, architecture students. While registering they would have to verify their working license, registration code of the studio, employee code, or college ID and institution name.

Another source of information could be the rating and comments for the components.

What would motivate them to upload the information?

- To connect with the community
- Gain Recognition
- Seek Help & share knowledge
- Sell components

The website is detailed at the wireframe level. A few important screens are done in high fidelity.

10.3.1 Information Architecture

1. Indian Traditional Architecture: Information about specific architectural styles. Along with relevant details about the resources, people associated with that architectural style.
2. Component Library:
   Contains the components developed by the users of the website. They can be downloaded & be used in the plugin.
3. Download Plugin: Consist of Traditional Architecture plugins.

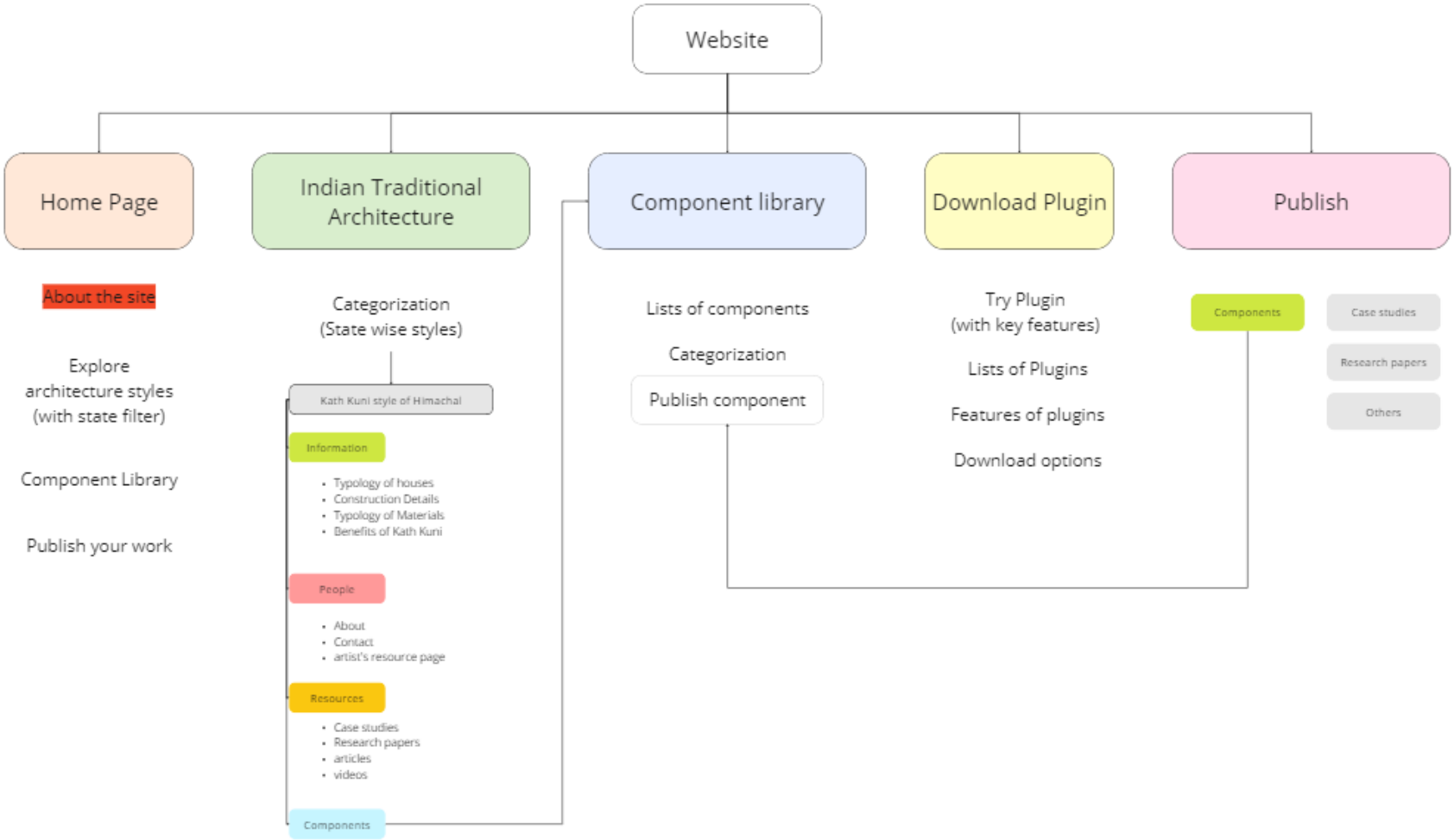


Fig 68: Information Architecture

10.3.2 Homepage

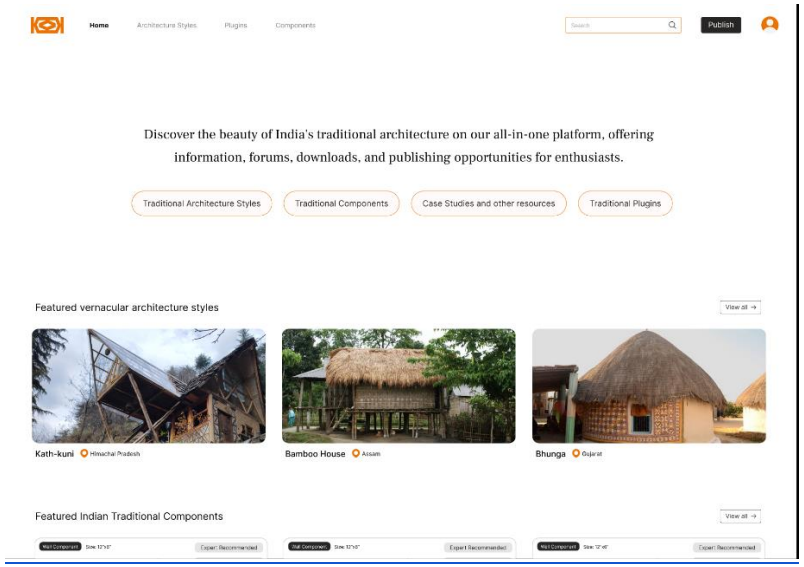


Fig 69: Homepage

10.3.3 Kath Kuni Information Page

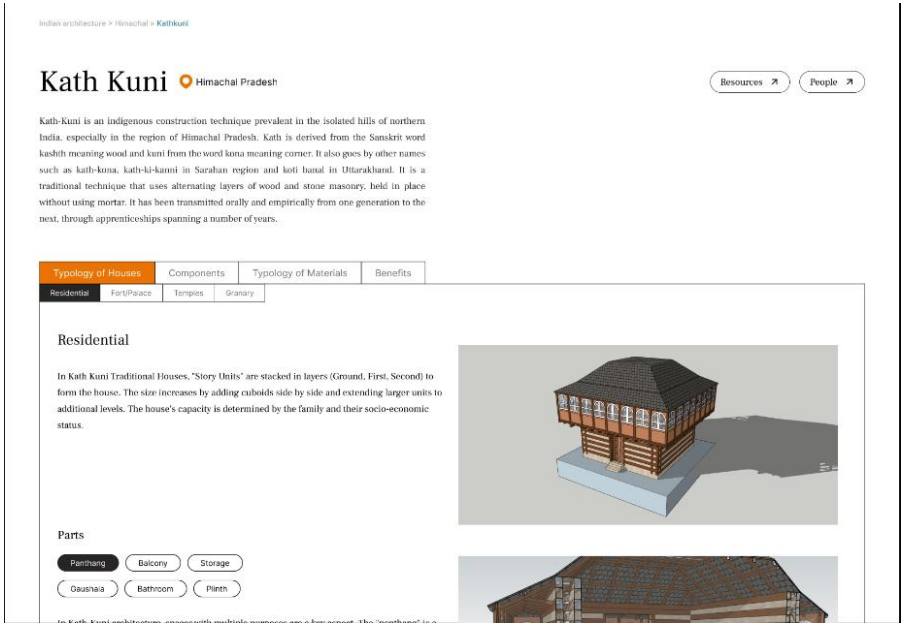
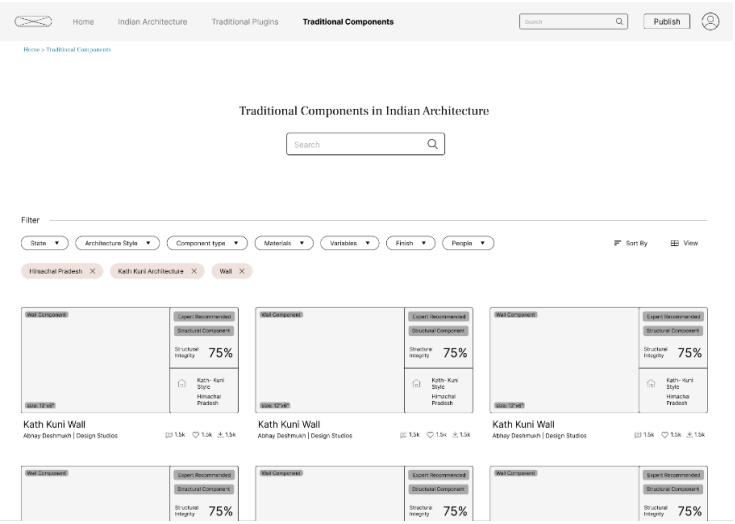
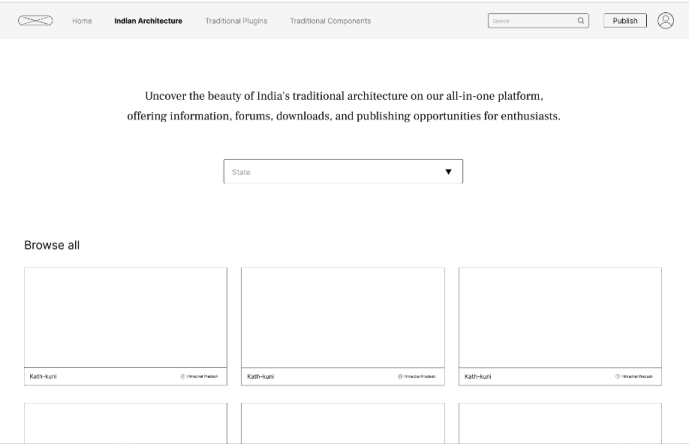


Fig 70: Info Page

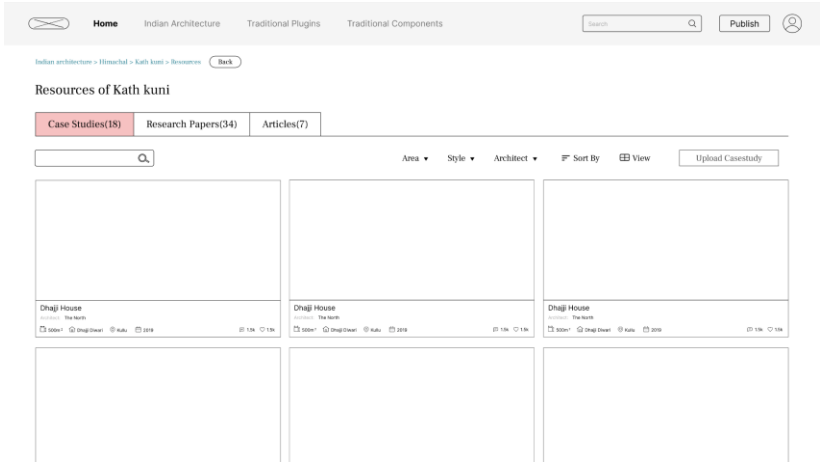
10.3.3 Traditional Components



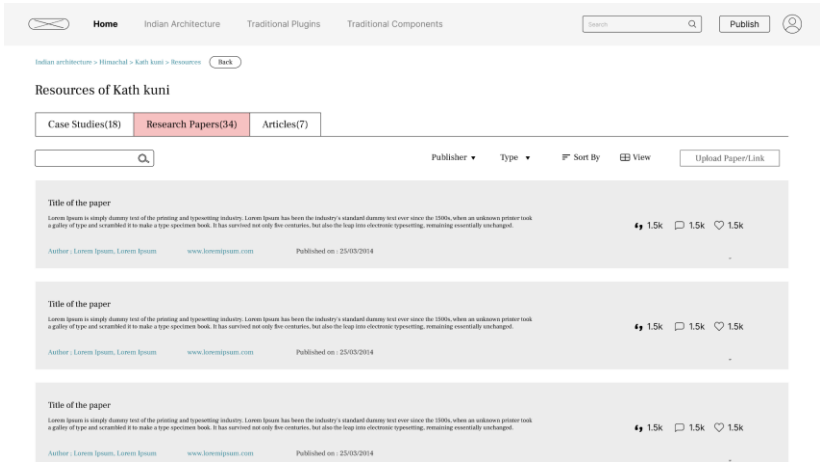
10.3.4 Indian Architecture Page



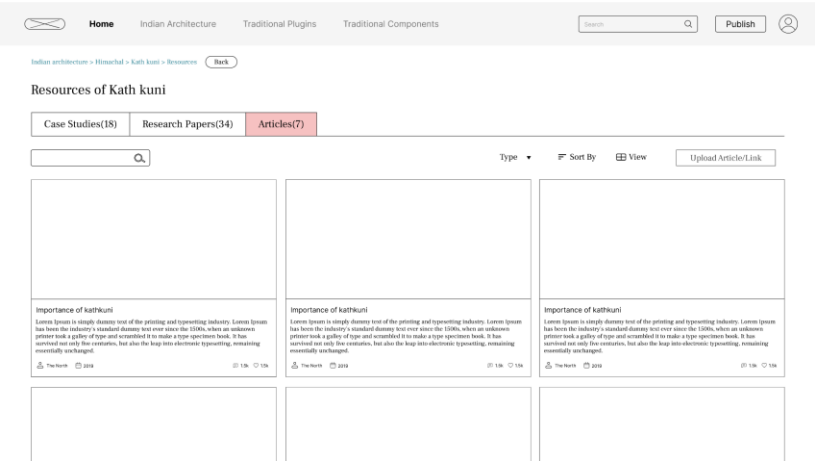
10.3.5 Case Study



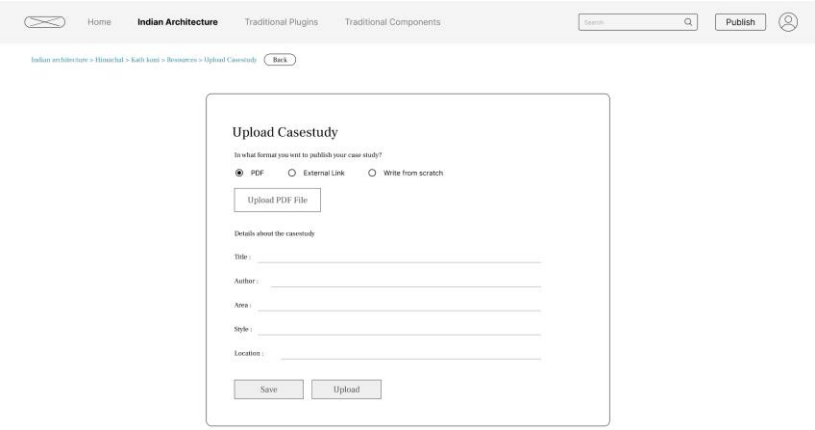
10.3.6 Research Paper



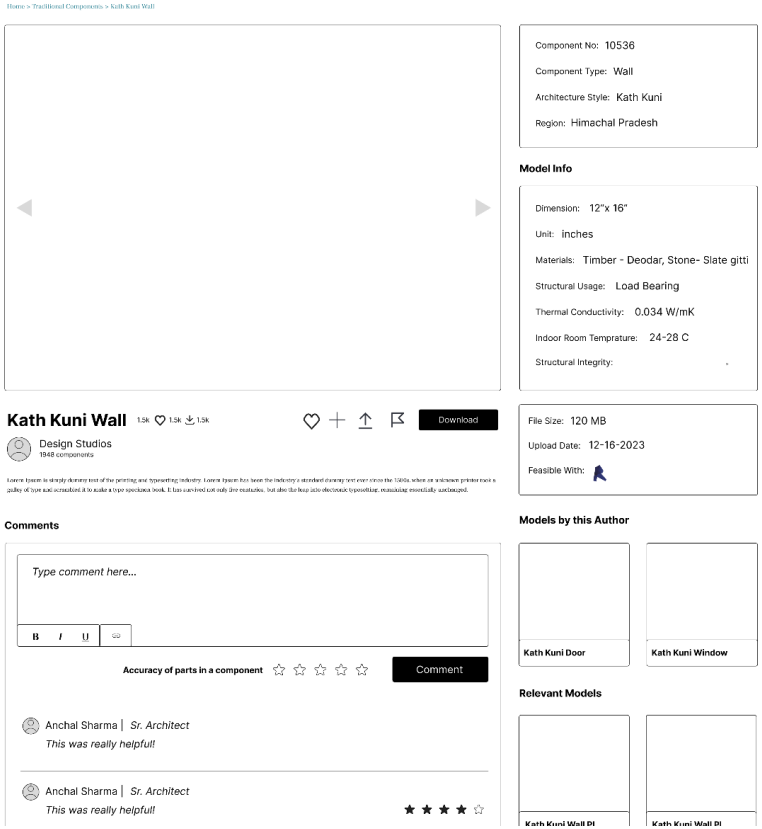
10.3.7 Articles



10.3.8 Upload Case study



10.3.9 Individual Component Page



10. Evaluation

1. Iterative Approach

- Need to have preliminary basic Kath Kuni information before selecting a component.
- Helped in restructuring the information architecture of the plugin.
- Verified the quantitative information that can be incorporated.

2. Expert Evaluation

I conducted an expert evaluation with 2 architects who practice the Traditional style of Architecture. One of the has done their Masters in Sustainable Architecture from SPA Vijayawada & currently works at PMA Madhushala as a Sr. Architect. The other evaluator is a Principal Architect on their own Design Studio. They are avid users of Revit. I explained the product and design solutions to them, and asked for their feedback. They found it to be user friendly and informative.

1. The concept of a plugin and dedicated website for traditional architecture was appreciated.
2. They felt that the analysis of spaces was a helpful tool but not something a lot of people would want to use. The steps taken to conduct the analysis, would be expected to give more information.
3. The information being curated and suggested to them by the plugin was appreciated.
4. Overall, they faced difficulty in reading the content in the plugin due to the smaller font size. The hierarchy of information in the layout needs to be improved.
5. They liked the component library, especially the View Properties and edit properties features. They felt it would really assist them in creating components.
6. They asked to reduce the amount of content in websites and make the information more visual.
7. They themselves mentioned that this website gives assurance regarding the information needed before choosing a Kath Kuni Component from the plugin.
8. They also mentioned certain techniques in Kath Kuni that would help in making the architectural design more efficient.
9. They also like the plugin notifying and doing some things automatically like the top door snapping to the timber beam.
10. More complicated use cases in Contemporary design, like dealing with curved doors or window frames could be explored.

On this feedback, the design is further improved.

2. User Evaluation.

The study design will be tested with 5 professional architects who are novices in Kath Kuni. They will be given the following tasks:

1. Add a Kath Kuni Wall.
2. Edit and add a layer in the wall component.
3. To view information about Panthang in the Website.
4. To add and align a Door to the wall.

The evaluation will be done and the results will be updated.

11. Limitations

- The flow of an architect within Revit can be varied.
- For the Plugin design only use case Wall and Openings have been considered. By incorporating components like Roof the design of the plugin could change.
- The use cases that were considered were the basic steps that the architect would have to do. Complex Cases and user flow would aid in the improvement of design.

12. Future Scope

- In future the plugin could incorporate more use cases and the design would be improved accordingly.
- More Traditional architecture plugins could be developed. The Kath Kuni Plugin could serve as a reference to design.
- With the development of AI, the process to assist could be made easier.
- The website repository could grow and documentation could be submitted in the repository. It could also act as a forum for users to discuss & share their ideas, opinion & seek guidance
-

13. Conclusion

The primary objective of the project was to revive Traditional Architecture in Himachal Pradesh, with a focus on empowering architects to incorporate Kath Kuni Architecture into their practice. Through extensive research and analysis, it was identified that architects play a significant role in construction projects and are key decision-makers throughout the process.

One of the gaps discovered was the lack of knowledge among architects regarding the structural aspects of Kath Kuni design. Architects sought affirmation and guidance in making informed decisions, as many were relatively new to this

architectural style. Understanding the architect's reliance on digital tools such as Autocad, Sketchup, and BIM software like Revit, it was recognized that integrating a Kath Kuni plugin into Revit could address the limitations faced during visualization, drafting, and ideation stages.

To develop the plugin and gain insights into Kath Kuni architecture, site documentation, interviews, and secondary research were conducted. The research also involved analyzing existing plugins and the capabilities of Revit. By focusing on information gathering, creating components, editing components, and implementing components, the aim was to facilitate the creation of conceptual ideas and detailed construction drawings specific to Kath Kuni architecture.

Furthermore, to enhance information sharing and community engagement, a repository was developed where architects can access verified content and participate in forum discussions. This resource empowers aspiring architects, allowing them to gain confidence and expand their knowledge of Kath Kuni architecture.

The project received overall positive feedback, with an emphasis on the need for executable and concise preliminary information. This feedback reinforced the project's impact and highlighted the importance of providing architects with accessible and practical resources.

In summary, the project focused on reviving Traditional Architecture in Himachal Pradesh by empowering architects through a Kath Kuni plugin for Revit, along with a repository for information sharing. The aim was to address gaps, provide reliable resources, and facilitate the incorporation of Kath Kuni architecture into architectural practices.

14. Reflections:

This project was a fresh and unparalleled experience for me, presenting a compelling challenge in striking a delicate equilibrium between a holistic perspective and meticulous attention to detail. Designing a plugin for Kath Kuni architecture proved to be a novel endeavour, as there were limited resources available for reference. I embarked on a new learning journey by adopting an iterative approach that involved real users, and the abundance of feedback received opened up unexplored variables that demanded further research. The cruciality of constraining the project's scope became evident as it allowed me to immerse myself in its intricacies and gain a comprehensive understanding. As an Interaction student designer, this reflective account showcases the distinctive path I traversed in creating a Kath Kuni Component and Website for vernacular architecture and the invaluable lessons garnered along the way.

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