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1 Introduction

1.1 Introduction to Topic

In today's fast-moving world, many applications make our lives easier by digitizing all types of day-to-day activities. Nevertheless, a lot of operations, particularly in industries like construction, depend extensively on manual processing, giving rise to lots of inefficiencies and errors. To address these problems and drive a fully digital transformation, my final year project focuses on developing an OnSite App.

This application is designed to assist builders and contractors in streamlining their operations at the construction site. The app helps builders track worker attendance, capture budget data, and monitor project progress. Traditionally, many construction site activities are handled manually, which can result in errors, inefficiencies, and delays. By providing a digital solution, this app aims to make the whole workflow easier by reducing paperwork and enhance overall productivity.

1.2 Problem Scenario

When builders and contractors receive a contract, they often rely on paper-based methods to keep records. This manual approach can lead to numerous errors, as they frequently depend on memories the document details after visiting the site. The delay between observing the work and recording it on paper increases the likelihood of forgotten details, resulting in inaccurate or incomplete records, which can create significant issues in tracking project progress and managing resources effectively.

Figure 1: Records of different contracts.

Additionally, in construction, builders are typically provided with a budget upfront. As they purchase materials throughout the project, they often lose track of the remaining funds, requiring frequent manual calculations to determine the remaining budget, which can be time-consuming and lead to mistakes. When it comes time to pay workers their weekly salaries, builders must maintain daily attendance records on paper and manually calculate salaries, which can also result in errors.

Figure 2: Budget record of the contract

Figure 3: Attendance of the worker

Moreover, builders often have numerous contacts for material suppliers, and they may forget or lose these important details over time.

These issues are not unique to builders even my father as a builder faces similar challenges in his work. This inspired me to develop an app that will assist him in his daily tasks and alleviate the pressure associated with managing these responsibilities. While these may seem like simple problems, I believe many contractors and builders experience similar difficulties, and this app could provide valuable supports.
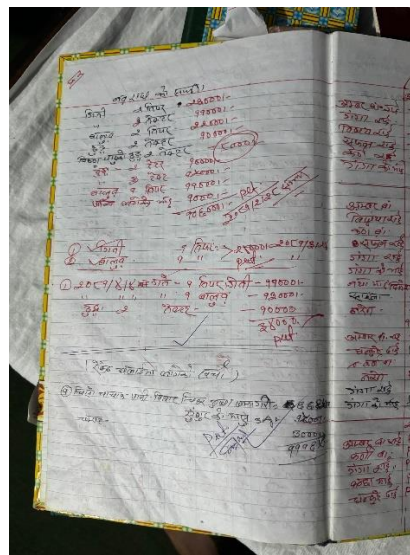

Figure 4: Calculating the material cost

1.3 Project as a solution

The OnSite application designed to offer a comprehensive digital solution to the problems builders and contractors face in managing construction site operations. By automating these processes, the application decreases inefficiencies and the error rates that are most prone to happening when tracking attendance, budget management, and project monitoring. The centralized platform simplifies operations, decreases dependence on memory and paper-based records, and promises to ensure better accuracy and productivity.

By integrating advanced technologies, such as AI and OCR into the app, it enhances decision-making and develops better collaboration between builders and clients. As these challenges are effectively tackled with the OnSite app, operational processes will be smoother and less prone to errors while providing an efficient experience for construction professionals, which again is beneficial not only for a builder like my father but also for many others.

2 Aims and Objectives

2.1 Aims

The aim of this project is to develop a user-friendly construction site app that streamlines worker attendance tracking, project progress monitoring, and budget management, while enhancing communication with clients to improve overall productivity and reduce errors in construction operations.

2.2 Objectives

1. To develop a user-friendly interface that allows builders and contractors to easily navigate and utilize the app's features.
2. To implement a real-time attendance tracking system that records worker presence accurately and efficiently.
3. To integrate a budget management tool that automatically updates remaining funds as expenses are logged, eliminating manual calculations.
4. To provide a secure database for storing supplier contact information, making it easily accessible for builders when needed.
5. To create the feature of visualizing 3D house models for better project understanding among clients.
6. To include a chatting feature that will help builders communicate seamlessly with clients to get problems resolved as fast as possible and collaborate on important notes.
7. To simplify salary payments through an online payment feature, ensuring secure and efficient transactions with automated record-keeping.

3 Expected Outcomes and Deliverables

Expected Outcomes

1. Enhanced accuracy in tracking worker attendance and project progress, leading to improved accountability.

2. Streamlined budget management, resulting in better financial oversight and reduced risk of overspending.

3. Reduced errors in salary calculations and attendance records, improving overall operational efficiency.

4. Easier access to supplier contacts information through Optical Character Recognition (OCR) and documents facilitating better resource management.

5. Increased transparency in communication between builders and clients regarding budget plans and expenditures.

6. Augmented Reality (AR) / 3D models to help builders and homeowners visualize projects.

7. AI-driven predictions for construction and sales costs based on user inputs.

8. Chats and notifications that allow for real-time communication, immediate updates, and increased collaboration between builders and home owner.

4 Projects risks, Threats and Contingency plans

SN	Risk Description	Probability	Impact	Contingency Plans
1	Technical Challenges with AR/3D Features.	High	High	- Allocate extra time for research. - Take help from domain expert.
2	Data Loss or Corruption	Low	High	- Regular backups of all databases. - Use of version control tools for backup.
3	Performance Issues on Mobile Devices	Medium	Medium	- Performance testing on various mobile devices. - Optimize code and resources for better performance.
4	Data Collection	Medium	High	- Manually collect data.
5	Unexpected bugs or software problems	High	High	- Maintain detailed documentation of the codebase.
6	Third-Party Dependency Failures	Medium	Medium	- Evaluate and choose reliable third-party APIs and tools. - alternative libraries or APIs.

Table 1: Projects risks, Threats and Contingency plans

5   Methodology

5.1   Considered Methodologies

5.1.1   Waterfall methodology

The Waterfall methodology is a linear, successive approach to project development wherein every phase, including requirements, design, implementation, testing, and deployment, needs to be finished before moving on to the next one.

Advantages: Clearly structured, well-defined milestones, and predictable timelines.

Disadvantages: rigidly inflexible to change, hence, it is unsuitable for projects whose requirement keeps changing.

Figure 5: Waterfall methodology (Blog, 2023)
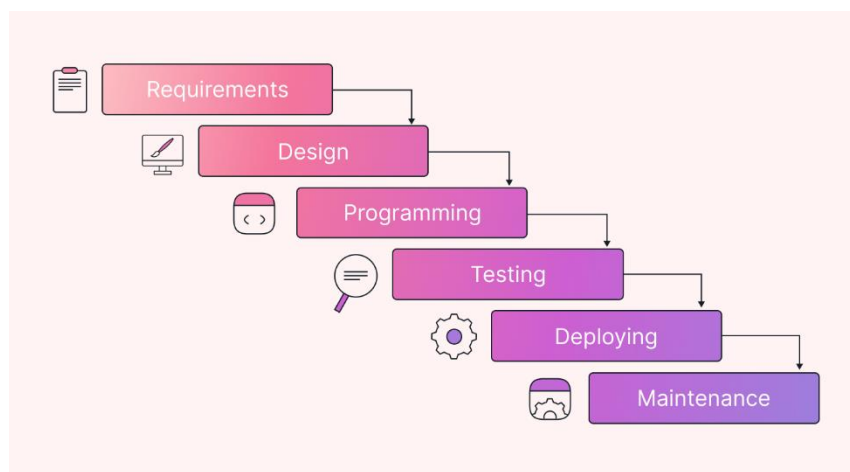
5.1.2   RUP methodology

RUP is an iterative approach that divides the project lifecycle into phases such as inception, elaboration, construction, and transition. (Minott, 2023)

- Advantages: Focuses on risk mitigation and enables iterative development
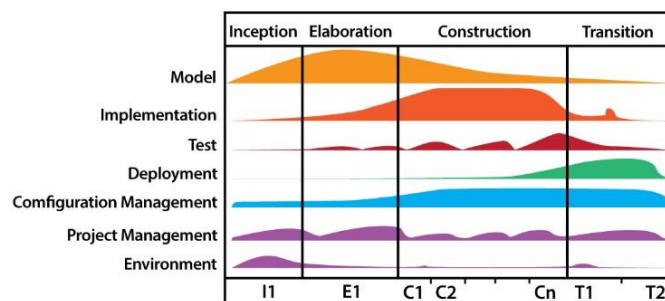- Disadvantages: Complexity in implementation and resource-intensive.

Figure 6: RUP methodology (testbytes, 2019)

5.2 Selected Methodology

In this project, the Scrum methodology has been chosen because it will go well with Agile. Scrum focuses on flexibility, adaptability, and collaboration, which goes hand in hand with the dynamic nature of software development. This project will be divided into 'sprints' lasting 2–4 weeks. These sprints are for continuous progress and regular feedback, hence the evolution in the project efficiently. Towards the end of each sprint, deliveries are made, and refining in light of feedback from the supervisor or stakeholders allows improvement in continuity of the development process. (Scrum Guides, 2020)
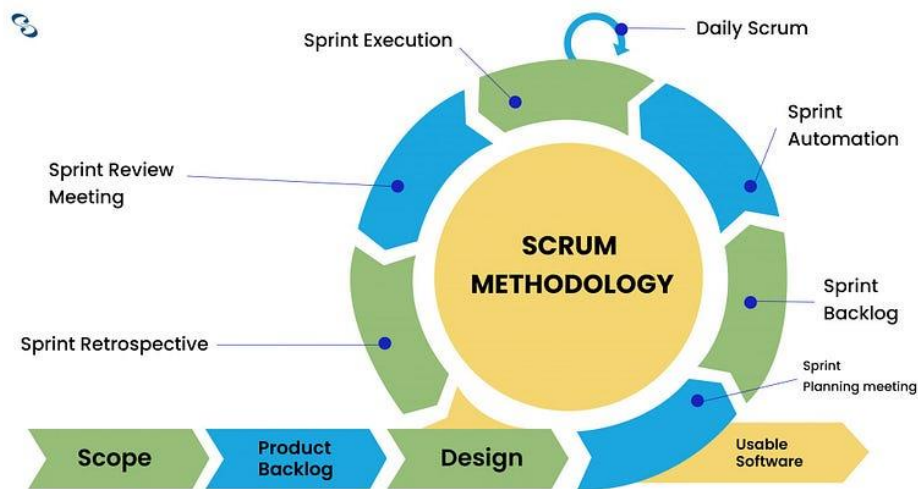

Figure 7: Scrum Methodology (korkut, 2023)

It can also be done as an individual project that focuses on sustaining effective communication with the supervisor and stakeholders through updates and feedback sessions that ensure consistency in maintaining the goals of the project, including improvement integration. The key components of Scrum in the Project are:

1. Product Backlog:

- It acts like a living, digital to-do list for the whole project. Of it all are features, enhancements, and tasks to be developed, like attendance tracking, budgeting management, AI-powered prediction capabilities, and 3D modeling capabilities.

- Backlog items will be prioritized relative to each other based on their value and relevance towards meeting the project objectives. This means the status of the items is

updated, and refactoring is done regularly throughout the project course. (Scrum Guides, 2020)

2. Sprint Backlog:

- A sprint backlog can be thought of at the beginning of each sprint; one will select a subset from the product backlog. Those elements represent the work that the Development Team will do during that particular sprint.

- This is an assured way of ensuring that the development team focuses on only the highest priority features in a certain period, without diversion of focus, hence increasing productivity.

3. Sprint Review:

- A sprint review is done at the end of each sprint in order to present the work that has been completed to the supervisor or stakeholder. The meeting enables feedback and thus ensures conformance to the goals of the project.

- Feedback from the sprint review will help refine the product backlog and guide subsequent sprints.

4. Sprint Testing:

- In each sprint, extensive testing will be performed to ensure that developed features are functional and work reliably. For example, attendance tracking will be checked for accuracy.

- This iterative testing approach helps identify and resolve bugs or issues early in the development cycle, reducing potential risks.

5. Retrospective:

- After each sprint, a retrospective will be performed to reflect on what was done well, what can be improved, and any lessons learned. This practice assures continuous improvement in the development process and in the way the team collaborates. (Scrum Guides, 2020)

The main reasons for using Scrum include the high level of adaptability of this methodology and its possibility of supporting ongoing feedback through iterative sprints, making it ideal in dynamic software development projects like OnSite. Unlike the Waterfall model, where there is a rigid, step-by-step flow from start to finish, needing a restart when changes are encountered, Scrum lets there be a flexible consideration of changeability. Similarly, while the RUP involves iterative phases, it is very often as structured as Waterfall, hence not that dynamic when it comes to frequent updates. Scrum, with its emphasis on regular updates and adjustments, ensures a user-focused, flexible development process-just what projects in a constantly changing environment need.

6   Resource Requirements

6.1   Hardware Requirements

- **Laptop:** It will be used in the development of the application. This device will serve as the main one for coding activities, application testing, and operation of development tools.
- **Mobile:** Since, I am developing a mobile app, a mobile device is essential for testing and ensuring the app functions properly on real devices, allowing for accurate performance and usability assessments.

6.2   Software Requirements

1. **Node.js:** Node.js is an environment that runs JavaScript outside the browser and on the server. It's for developing the application backend, handling API requests, and maintaining server-side logic. Because it is asynchronous and event-driven, it goes very well with scalability.

2. **React Native:** React Native is a well-known open-source framework by Facebook for building cross-platform applications. This means the mobile developer can design the mobile application for iOS and Android from a single codebase. Development will be much quicker with a native-like user experience.

3. **MySql:** MySQL is a relational database management system that is used to store data for applications. It is designed with a structure and efficiency in carrying out its functions, thus allowing the handling of complex inquiries and relationships.

4. **Prisma:** Prisma is a modern, open-source ORM tool that makes the work of developers with databases much easier. It stands in the middle between an application and a database, thus enabling efficient data modeling, querying, and migrations. In the project of the OnSite app, Prisma will be used to simplify database operations, such as those with MySQL, and speed up development while reducing possible errors in handling complex database queries.

5. **Postman:** Among API development and testing tools, it happens to be one of the favorites because it simplifies so much in creating, testing, and debugging APIs. In this OnSite app, this would be used during development for testing server-side endpoints in communication with the backend to the frontend.
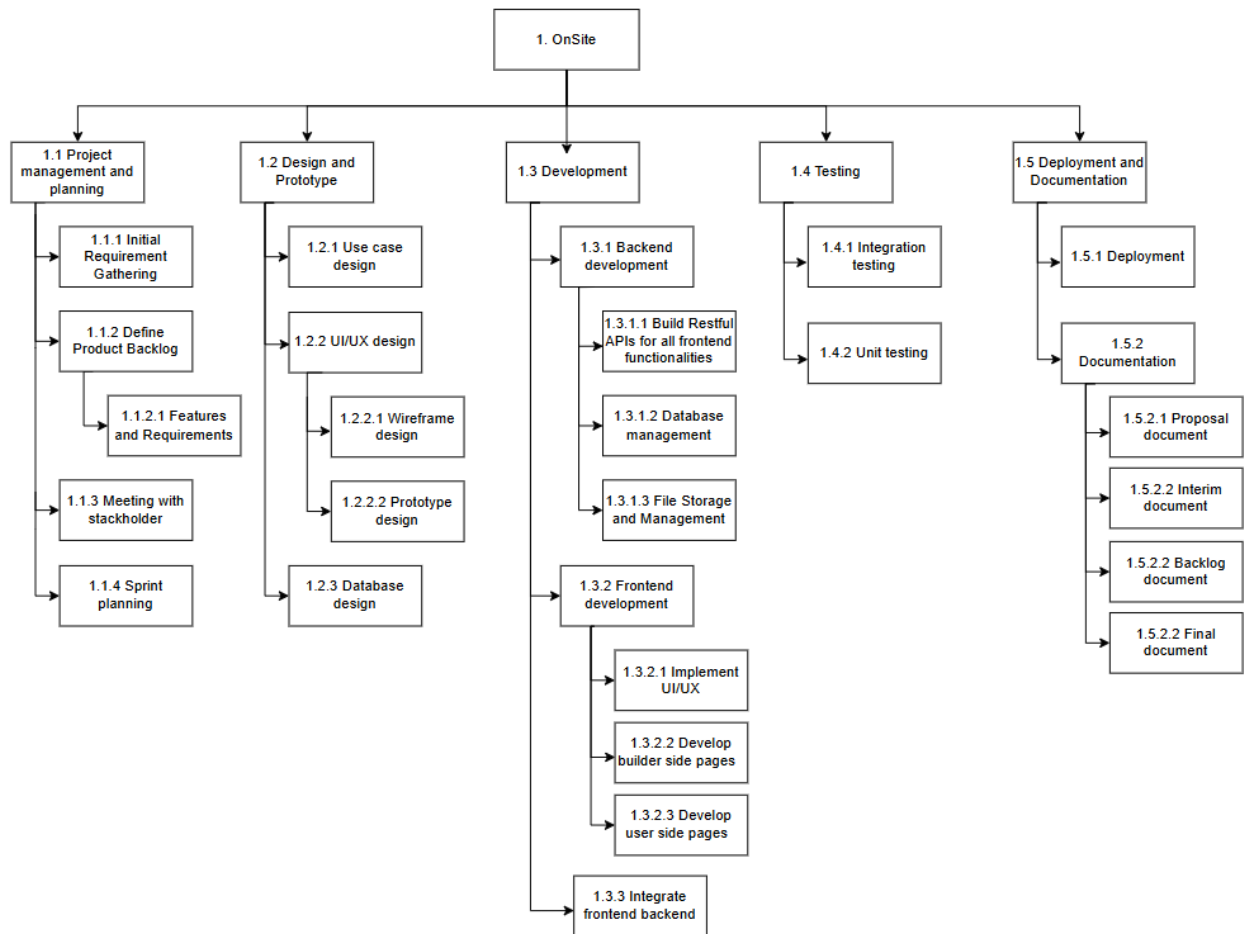
7 Work Breakdown Structure

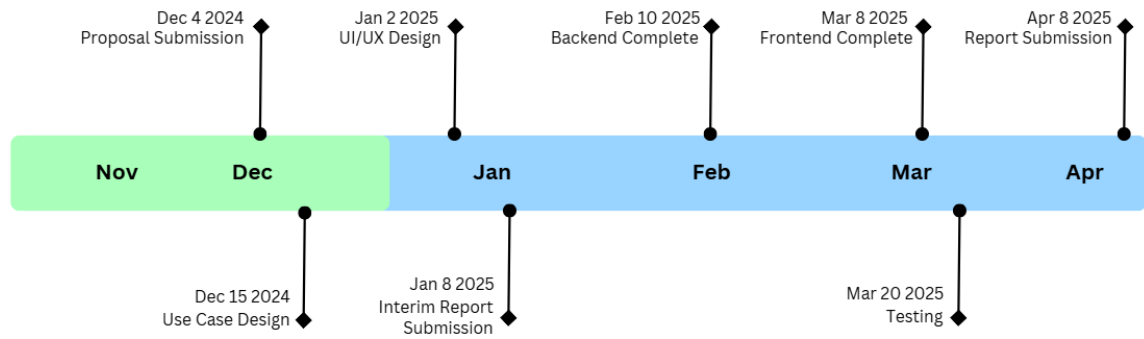Figure 8: Work Breakdown Structure

8 Milestones Chart

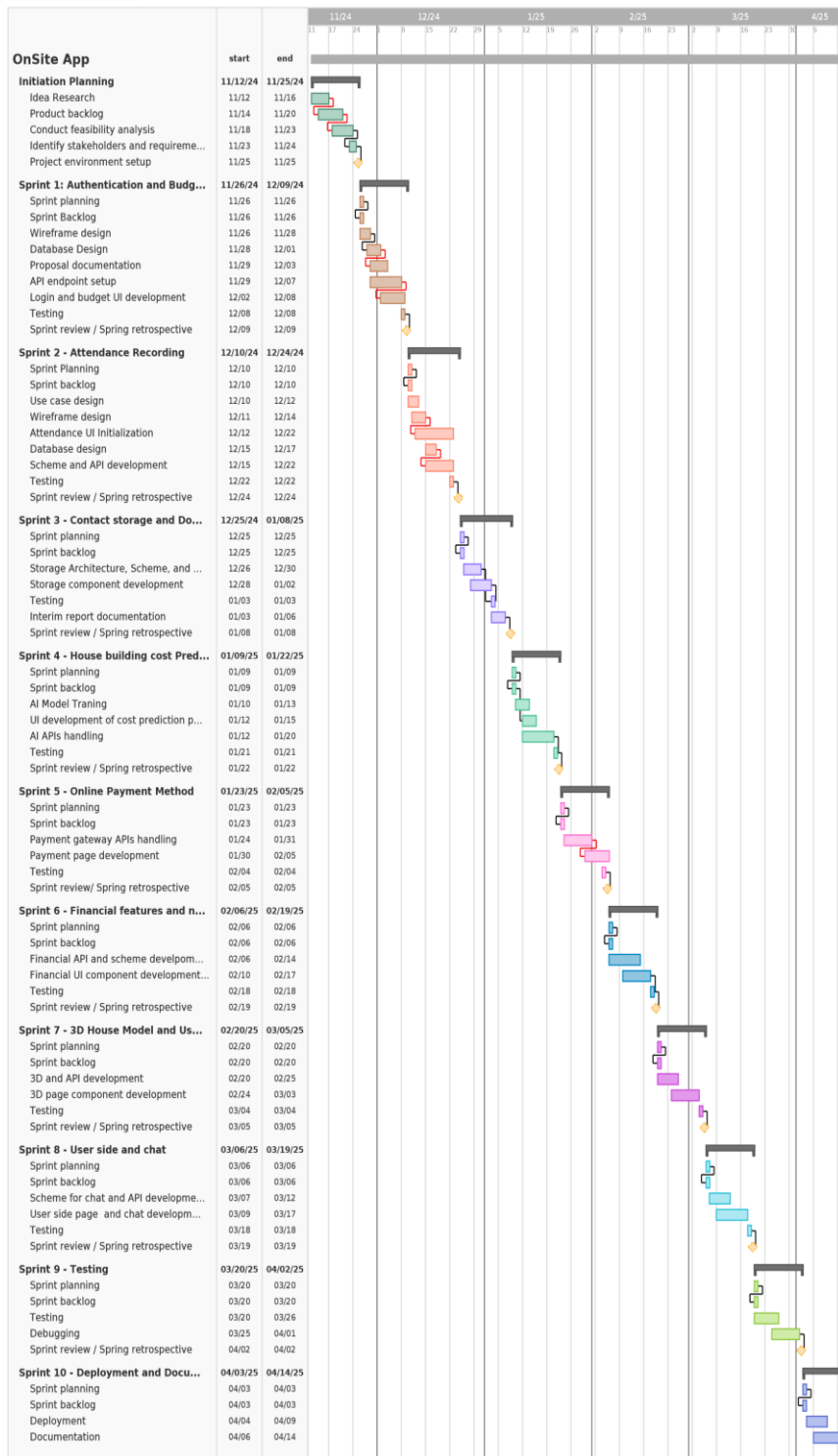Figure 9: Milestones chart

9 Project Gantt Chart

Figure 10: Gantt Chart

10 Conclusion

In Conclusion, the OnSite app is to solve the builder's and contractor's problems efficiently and in a very user-friendly manner. The app digitizes the operations, such as attendance, budgeting, and project progress, to reduce manual errors and enhance productivity. With the integration of advanced features like AI-driven predictions, AR/3D models, the app ensures a seamless workflow for users.

The development of this project involves rigorous planning, continuous testing, and regular feedback for the delivery of a quality product. Every phase of the project will be carried out systematically with utmost effort and dedication. This project addresses real-world problems that builders face and is also an invaluable learning experience that will contribute to my professional growth and skill as a developer.

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12 Abstract

12.1 Features in Details

1. **Budget Tracking**: The app will allow builders to enter expenses as they buy materials, providing immediate updates on remaining funds without the need for manual calculations reducing the likelihood of errors and ensuring accurate financial management. It also gives a really clear view of spending patterns, which enables the builder to analyze the costs, adjust the spending strategy, and eventually make an informed decision that keeps the project on budget at all times.

2. **Attendance Recording**: Builders can effortlessly record daily attendance digitally for workers across multiple sites. This streamlined process ensures accurate tracking and simplifies the calculation of weekly salaries.

3. **Financial Features:** The app includes advanced financial tools that improve accounting and financial management for builders and construction professionals. It allows automated creation of journal entries and trial balances, which ensures that financial documents are accurate and updated. These attributes help builders to have a clear view of their income and expenses so that they can easily follow their financial progress.

4. **House building cost Prediction (AI):** It helps to estimate the cost of constructing a house before the building process begins. It calculates costs based on key factors such as land area, the number of floors, and the total number of rooms. This AI-driven solution enables builders and homeowners to plan budgets effectively, make informed decisions, and avoid unexpected expenses during construction.

5. **House Selling Cost Prediction (AI):** It helps to estimate the selling price of a house based on its construction cost, the number of rooms, and other key factors. This AI-powered solution provides builders and customers with a reliable starting point for price negotiations.

6. **Augmented Reality/ 3D House Model:** The app offers 3D models of houses under construction, allowing customers to visualize the design in a interactive way. This feature enhances understanding and helps in making informed decisions about the project.

7. **Contact Storage**: The app will keep important supplier contact information in one place, helping builders avoid losing important details and facilitating easier communication. Optionally it will extract the data by scanning the visiting card and extracting the details and storing the app, which will make it easier and faster.

8. **Document Storage:** A centralized repository for storing important documents, such as blueprints, permits, and contracts. This feature ensures that all critical files are easily accessible at any time.

9. **Notification:** The app provides real-time notifications for important updates, such as Attendance reminder, financial report, app updates ,etc. This ensures builders and contractors stay informed about critical developments.

10. **Online Payment Method:** This feature simplifies salary payments by allowing builders to transfer wages directly to workers through the app. It ensures secure, fast, and transparent transactions, with automatic records for easy tracking. Notifications confirm successful payments, making the process efficient and error-free.

11. **Chat:** The app includes a chat feature that allows communication between the builder and the client. Clients can quickly raise concerns about their house, such as design issues or construction problems, and receive from the builder. Builders can share updates, schedules, and solutions, while clients can send photos or documents. This efficient communication ensures faster problem resolution and enhances overall project collaboration.