SMARTHOME SOLUTIONS - INNOVATION

PROJECT MANAGEMENT PLAN

Final Version

07/05/2023

VERSION HISTORY

Version #	Implemented By	Revision Date	Approved By	Approval Date	Reason
1.0	*Ankita Savaliya*	*06/23/2023*			*Initial Draft*
2.0	*Erick Tinoco*	*06/28/2023*			*Added Introduction, Scope Management*
3.0	*Ankita Savaliya*	*06/29/2023*			*Added Communication Management, HR Management, Quality Management*
4.0	*Dhwani Vaishnav*	*06/30/2023*			*Added Schedule Management, COCOMO calculations, Cost management,*
5.0	*Dhwani Vaishnav, Ankita Savaliya*	*07/05/2023*			*Added Risk Management, Final Version*

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1. INTRODUCTION

1.1 PURPOSE OF PROJECT MANAGEMENT PLAN

The purpose of "SmartHome Solutions" is to transform houses into smart, interconnected homes by creating and providing the best smart home products. The objective of this project is to foster innovation in smart home products by incorporating advanced technologies and enhancing connectivity. The aim is to create a holistic solution that revolutionizes conventional manufacturing methods into intelligent and interconnected systems. The primary focus is to offer customers effortless control and monitoring abilities, enabling efficient management of their smart homes. Additionally, the project emphasizes enhancing functionality, optimizing the user experience, and ensuring scalability to cater to the changing demands of the market. Ultimately, the goal is to position the company as a frontrunner in the smart home industry through the delivery of innovative, feature-rich products that surpass customer expectations.

The intended audience of the ***SmartHome Solutions - Innovation*** PMP is all project stakeholders including the project sponsor, senior leadership, and the project team.

2. EXECUTIVE SUMMARY OF PROJECT CHARTER

SmartHome Solutions is a leading company specializing in the development and manufacturing of innovative smart home products. With a strong focus on connectivity, convenience, and efficiency, we offer a wide range of cutting-edge solutions that transform ordinary houses into smart, interconnected homes. Our product portfolio includes devices such as smart thermostats, smart lighting systems, smart security cameras, and smart home hubs. With our expertise in product development and commitment to innovation, we continue to shape the future of smart home technology.

2.1 ISSUES

Our company, known for its wide range of smart home products, aims to revolutionize the way people interact with their living spaces. However, we are currently facing a significant challenge in the market due to a lack of innovation in our offerings. While our competitors are continuously introducing new and advanced features, our products have fallen behind in terms of market competence and customer appeal. To address this issue and regain our competitive edge, we need to invest in research and development, foster a culture of innovation, and collaborate with technology partners.

2.2 RECOMMENDATION

Two alternatives are considered to address this problem: IoT (Internet of Things) innovation and AI (Artificial Intelligence) innovation. IoT innovation focuses on connectivity and enables remote control, automation, and data analysis. AI innovation focuses on making smart home products intelligent, adaptive, and capable of personalized interactions.

Based on a scoring model considering various criteria, the preferred alternative is AI innovation (Alternative B). It scored higher in financial metrics, organizational alignment, project development, technical complexity, integration capability, customer satisfaction, user adoption, and data privacy & security. The result indicates that AI innovation aligns better with strategic objectives, offers a higher likelihood of reaching projected goals, and demonstrates a strong potential for financial return on investment.

2.3 JUSTIFICATION

The recommended solution of *AI innovation* in smart home products offers a range of values to enhance the overall smart home experience. With increased connectivity, the solution enables seamless communication and data sharing among devices, creating an interconnected ecosystem. The integration of AI technology brings intelligence to smart home products, allowing them to understand user behavior, respond to voice commands, and provide personalized recommendations. Automation features optimize functions based on user preferences and predictive analytics, making the user experience more convenient and efficient. Furthermore, AI innovation enhances security measures through anomaly detection and proactive protection, ensuring user privacy and data security. By focusing on user experience, efficiency, and future-readiness, the recommended solution positions the company at the forefront of the market, providing customers with advanced, personalized, and future-proof smart home experiences.

2.4 ASSUMPTIONS/CONSTRAINTS

In the world of project management, assumptions refer to any aspect of a project that the project manager believes will occur without any logical reasoning other than experience. In any project, there are assumptions, but the idea is to be realistic and prepare for the worst in any scenario. In terms of our project, assumptions include:

- Team members will have the resources needed to complete their daily tasks without delays
- Day-to-day expenses will be consistent throughout the project's life cycle
- Scope of the project will not be increased our decreased during the life cycle

On the other hand, project constraints are the barriers the team needs to work within. Like in any other project, our constraints will mostly consist of:

- The project's budget
- The project's deadlines
- The project's resources

3. SCOPE MANAGEMENT

The scope of SmartHome solutions must be firmly established at the beginning of the project to avoid the scope being increased or decreased. If either or, this would involve the team working longer hours either adding or removing features and services. With that being said, the scope management will consist of:

- Establishing a Project Plan
- Recruitment for the Team
- Product Development & Tests
- Marketing to push the product to the public

3.1 WORK BREAKDOWN STRUCTURE

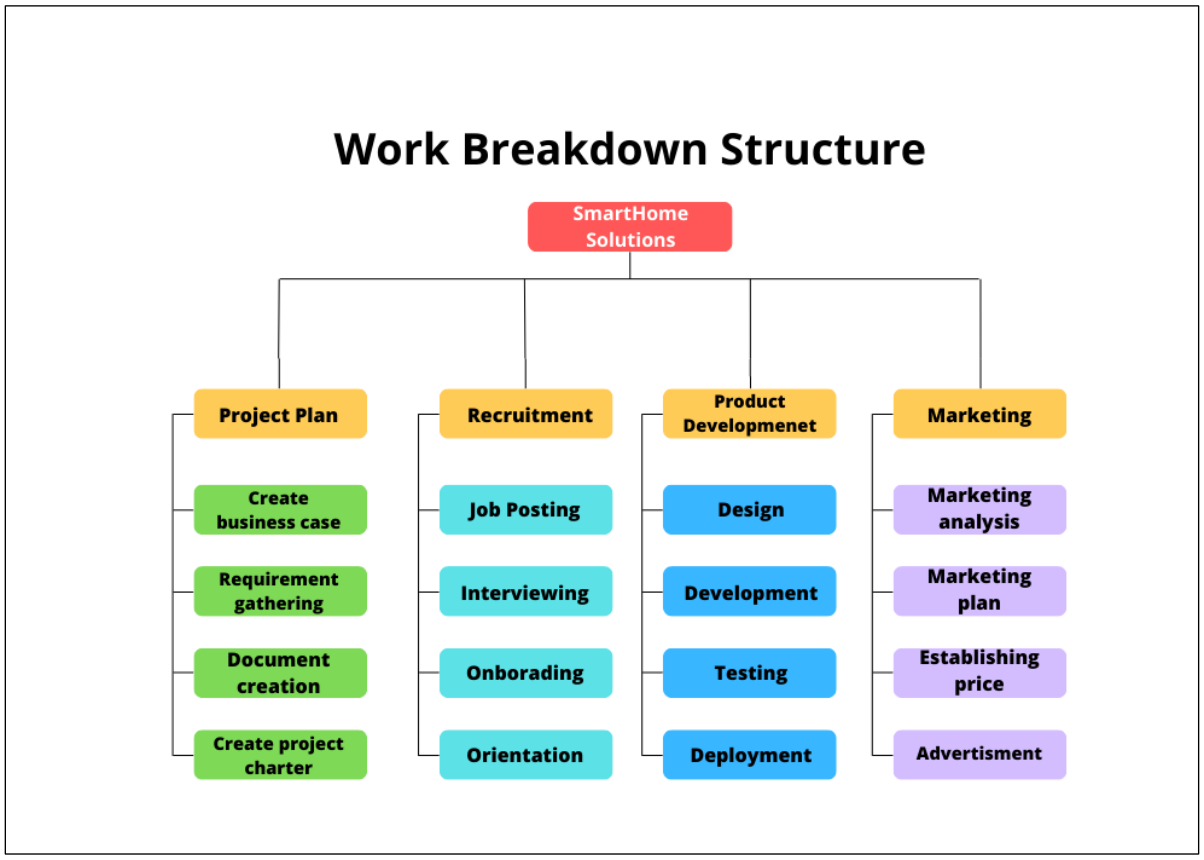


Figure 1 Scope - Work Breakdown Structure

3.2 DELIVERABLE DEFINITION TABLE (DDT)

Deliverable	Structure	Standards	Approval Needed By	Resources Required
Business Case	Document outlining the justification and financial analysis of the smart home solution	Company business case template	Project sponsor	Project manager, stakeholders, finance team
Project Proposal	Document outlining project objectives, scope, timeline, and resources	Company project proposal template	Project sponsor	Project manager, stakeholders
System Architecture	Detailed diagram of smart home system components and connectivity	Industry best practices, smart home standards	Project manager, technical team	System architect, engineers
User Requirements Specification	Document specifying user needs and desired functionalities	User interviews, market research	Project manager, stakeholders	Business analyst, UX designer
Hardware Specifications	List of recommended or required hardware components	Smart home industry standards, compatibility requirements	Project manager, technical team	Hardware specialist, procurement team
Software Specifications	Detailed specifications for software components	Software development best practices,	Project manager, technical team	Software architect, developers

		interoperability guidelines		
User Interface Design	Wireframes or mockups of the smart home system's user interface	UI/UX design principles, accessibility guidelines	Project manager, UX designer	UX designer, graphic designer
Data Security and Privacy Plan	Plan outlining measures and protocols for securing user data	Privacy regulations, encryption standards	Project manager, security team	Security specialist, data analyst
Installation and Configuration Guidelines	Instructions for installing and configuring the smart home system	Installation best practices, user-friendly guidelines	Project manager, technical team	Installation technicians, technical writers
Testing and Quality Assurance	Test plans, test cases, and reports for ensuring system functionality	Quality assurance standards, testing methodologies	Project manager, QA team	QA testers, test analysts
User Documentation	Comprehensive user manuals or guides for operating the smart home system	User-friendly language, clear instructions	Project manager, technical writers	Technical writers, graphic designers
Training Materials	Materials for training users on the smart home system's features and operation	Training standards, instructional design principles	Project manager, trainers	Trainers, instructional designers

Maintenance and Support Plan	Plan for ongoing maintenance and support of the smart home system	Maintenance best practices, support service level agreements	Project manager, support team	Support specialists, maintenance technicians
Android Application Development	Android application codebase, UI/UX design	Android development guidelines, platform-specific requirements	Mobile development team, project manager	Android developers, UI/UX designers
iOS Application Development	iOS application codebase, UI/UX design	iOS development guidelines, platform-specific requirements	Mobile development team, project manager	iOS developers, UI/UX designers
Web Application Development	Web application codebase, UI/UX design	Web development frameworks, responsive design principles	Web development team, project manager	Front-end developers, back-end developers

Table 1 Deliverable Definition Table

3.3 DEPLOYMENT PLAN

The Deployment Strategy section of this document provides an overview of the deployment strategy planned for the software application/system. Included in the deployment strategy is timeline information, a description of the deployment approach, and associated benefits, assumptions, and risks.

DEPLOYMENT OVERVIEW			
Number of Sites or Release Recipients	**Target Deployments**	**Target Group**	**Scheduled Dates**
During this phase, property owners will receive our product to implement it on their properties. After implementation, the owners will provide us with feedback so we can understand their experience, improve	This is a joint effort between the development team and property owners.	Release for deployment team and property owners.	07/01/2024

in product's growth areas, and enhance user guides.	Product will be available after extensive testing	The recipients who will receive the product will be deployment team and property owners.	07/08/2024

DEPLOYMENT APPROACH

Description

The deployment approach will consist of a quarterly release cycle. This cycle was chosen because we want to make sure that security for this product and the mobile application is fully secured so no malicious users can steal our customer's information. Also, we want our non-tech-savvy users to be comfortable with our product and one change could cause customer dissatisfaction.

In terms of pushing software updates, we will be using the big bang deployment. Since we will have hundreds of products and customers to manage all at once, it is best to release all the necessary updates to everyone at once. With this deployment implemented, troubleshooting remotely will be easier for us since everyone has the same version of product and software.

Benefits (Tangible and Intangible) and Risks

Tangible Benefits:

- Increase in revenue
- Harden devices
- Decrease in logistical expenses

Intangible Benefits:

- Customers feel supported with updates
- Tighter security with firmware
- Administrator can manage easier

ASSUMPTIONS AND RISKS

Assumptions

Software updates will be released in timely manner

Instructions in user guide are easy to follow

Proper installation of product on property

Products are securely connected to our servers

Risks

Possible security hacks

Product defects

Software update causes crashes

Table 2 Deployment Plan

3.4 CHANGE CONTROL MANAGEMENT

Change control management plays a crucial role in ensuring effective management of changes throughout the AI innovation project for smart home products. The purpose of change control management is to ensure that all changes are properly documented, evaluated, approved, and implemented in a controlled manner. This helps to maintain project integrity, minimize risks, and optimize resource utilization.

When a change is identified or requested within the project, the Change Request Form is utilized to capture and document the details of the proposed change. This form serves as a formalized process for initiating change control activities. The Change Request Form should include essential information such as the reason for the change, the desired outcome, the impact on project scope, schedule, and resources, as well as any associated risks and dependencies. For the template of Change Request Form, please refer Figure 2

Once a Change Request Form is submitted, the change control process kicks in. The change request is evaluated by the designated change control board or change control manager, who assesses the potential impact of the change on the project's objectives, timeline, budget, and quality. This evaluation involves considering the feasibility, benefits, risks, and alignment with project goals and stakeholder expectations.

For significant changes, especially those that may impact project scope, budget, or timeline, approval from primary stakeholders and project sponsors is required. The change control board or manager facilitates the review and approval process, ensuring that the change aligns with the project's strategic objectives and benefits outweigh potential drawbacks.

Once approved, the change is documented, and necessary updates are made to the project's documentation, plans, and schedules. Any impacted stakeholders or project team members are informed about the approved change and its implications. It is crucial to maintain clear communication channels to ensure that everyone involved is aware of the change and any adjustments required in their respective areas of responsibility.

Scope Change Request Form

Requestor Name: _____ Request Date: _____
Request Title: _____ Request Number: _____
Request Description:

Justification:

-
Possible Alternatives:

-

Impacts	Alternative 1	Alternative 2	Alternative 3
Scope			
Schedule			
Resources Required			
Cost			

Recommendation:

-
Authorized By:

-
Date:

Figure 2 Scope – Change Request Form Template

The Change Request Form is available in the Project Repository.

4. SCHEDULE/TIME MANAGEMENT

4.1 MILESTONES

Milestones are crucial checkpoints in a project plan that help track progress and ensure successful completion of the project's goals. In this project plan, the main objective is to drive innovation in smart home products by integrating advanced technologies and enhancing connectivity.

The following timeline outlines the key milestones for the project, along with their estimated completion timeframes. It focuses on major project milestones that mark the completion of project phases. Please note that there might be additional smaller milestones not included in this timeline but accounted for in the project schedule and work breakdown structure.

In the event of any scheduling delays that could affect a milestone or delivery date, it is crucial to promptly inform the project manager. This will enable proactive measures to be taken in order to mitigate any potential delays. Any approved changes to these milestones or dates will be effectively communicated to the project team by the project manager.

The table below lists the milestones for this project, along with their estimated completion timeframe.

Milestones	Estimated Duration
Project Initiation	15 days
Product Design Phase	170 days
Data Collection and Preparation	55 days
Model Development	125 days
Prototype Development and Testing	60 days
Integration and System Testing	95 days
Web Application Development	45 days
Mobile Application Development	70 days

Table 3 Milestone Estimations

The below figures show the timeline with the milestones for this project, along with their estimated completion timeframe.

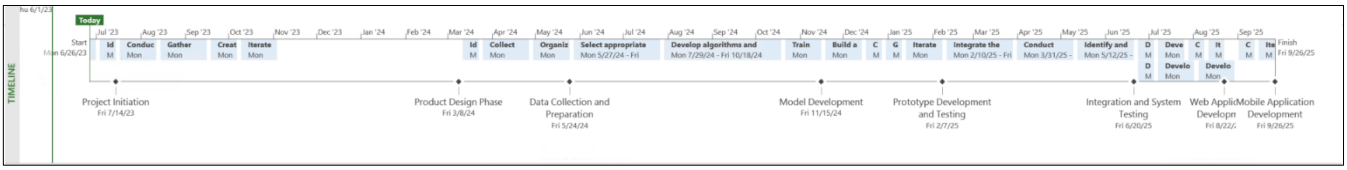
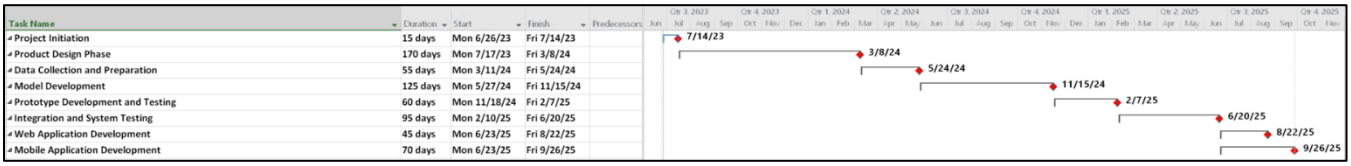


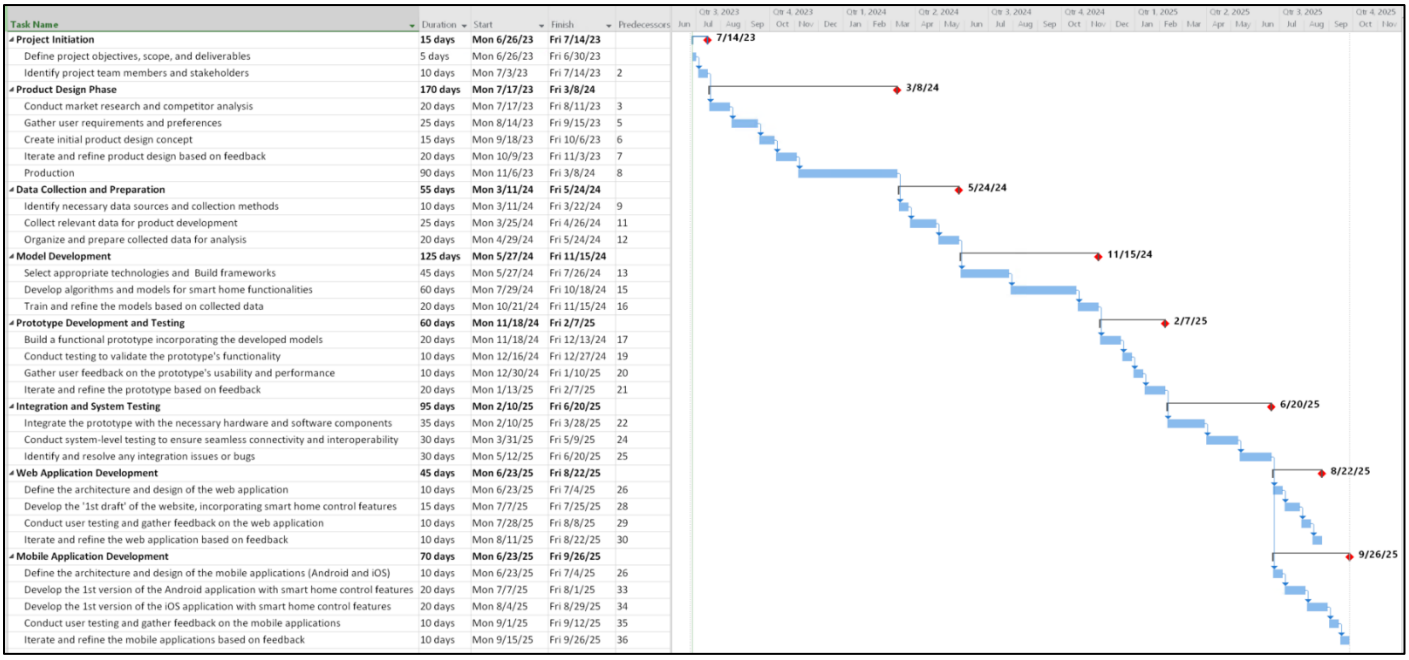
Figure 3 Project Timeline



Task Name	Duration	Start	Finish	Predecessors
Project Initiation	15 days	Mon 6/26/23	Fri 7/14/23	
Product Design Phase	170 days	Mon 7/17/23	Fri 3/8/24	
Data Collection and Preparation	55 days	Mon 3/11/24	Fri 5/24/24	
Model Development	125 days	Mon 5/27/24	Fri 11/15/24	
Prototype Development and Testing	60 days	Mon 11/18/24	Fri 2/7/25	
Integration and System Testing	95 days	Mon 2/10/25	Fri 6/20/25	
Web Application Development	45 days	Mon 6/23/25	Fri 8/22/25	
Mobile Application Development	70 days	Mon 6/23/25	Fri 9/26/25	

Figure 4 Project Milestones

4.2 PROJECT SCHEDULE (GANNT CHART)



Task Name	Duration	Start	Finish	Predecessors
Project Initiation	**15 days**	**Mon 6/26/23**	**Fri 7/14/23**	
Define project objectives, scope, and deliverables	5 days	Mon 6/26/23	Fri 6/30/23	
Identify project team members and stakeholders	10 days	Mon 7/3/23	Fri 7/14/23	2
Product Design Phase	**170 days**	**Mon 7/17/23**	**Fri 3/8/24**	
Conduct market research and competitor analysis	20 days	Mon 7/17/23	Fri 8/11/23	3
Gather user requirements and preferences	25 days	Mon 8/14/23	Fri 9/15/23	5
Create initial product design concept	15 days	Mon 9/18/23	Fri 10/6/23	6
Iterate and refine product design based on feedback	20 days	Mon 10/9/23	Fri 11/3/23	7
Production	90 days	Mon 11/6/23	Fri 3/8/24	8
Data Collection and Preparation	**55 days**	**Mon 3/11/24**	**Fri 5/24/24**	
Identify necessary data sources and collection methods	10 days	Mon 3/11/24	Fri 3/22/24	9
Collect relevant data for product development	25 days	Mon 3/25/24	Fri 4/26/24	11
Organize and prepare collected data for analysis	20 days	Mon 4/29/24	Fri 5/24/24	12
Model Development	**125 days**	**Mon 5/27/24**	**Fri 11/15/24**	
Select appropriate technologies and Build frameworks	45 days	Mon 5/27/24	Fri 7/26/24	13
Develop algorithms and models for smart home functionalities	60 days	Mon 7/29/24	Fri 10/18/24	15
Train and refine the models based on collected data	20 days	Mon 10/21/24	Fri 11/15/24	16
Prototype Development and Testing	**60 days**	**Mon 11/18/24**	**Fri 2/7/25**	
Build a functional prototype incorporating the developed models	20 days	Mon 11/18/24	Fri 12/13/24	17
Conduct testing to validate the prototype's functionality	10 days	Mon 12/16/24	Fri 12/27/24	19
Gather user feedback on the prototype's usability and performance	10 days	Mon 12/30/24	Fri 1/10/25	20
Iterate and refine the prototype based on feedback	20 days	Mon 1/13/25	Fri 2/7/25	21
Integration and System Testing	**95 days**	**Mon 2/10/25**	**Fri 6/20/25**	
Integrate the prototype with the necessary hardware and software components	35 days	Mon 2/10/25	Fri 3/28/25	22
Conduct system-level testing to ensure seamless connectivity and interoperability	30 days	Mon 3/31/25	Fri 5/9/25	24
Identify and resolve any integration issues or bugs	30 days	Mon 5/12/25	Fri 6/20/25	25
Web Application Development	**45 days**	**Mon 6/23/25**	**Fri 8/22/25**	
Define the architecture and design of the web application	10 days	Mon 6/23/25	Fri 7/4/25	26
Develop the '1st draft' of the website, incorporating smart home control features	15 days	Mon 7/7/25	Fri 7/25/25	28
Conduct user testing and gather feedback on the web application	10 days	Mon 7/28/25	Fri 8/8/25	29
Iterate and refine the web application based on feedback	10 days	Mon 8/11/25	Fri 8/22/25	30
Mobile Application Development	**70 days**	**Mon 6/23/25**	**Fri 9/26/25**	
Define the architecture and design of the mobile applications (Android and iOS)	10 days	Mon 6/23/25	Fri 7/4/25	26
Develop the 1st version of the Android application with smart home control features	20 days	Mon 7/7/25	Fri 8/1/25	33
Develop the 1st version of the iOS application with smart home control features	20 days	Mon 8/4/25	Fri 8/29/25	34
Conduct user testing and gather feedback on the mobile applications	10 days	Mon 9/1/25	Fri 9/12/25	35
Iterate and refine the mobile applications based on feedback	10 days	Mon 9/15/25	Fri 9/26/25	36

Figure 5 Scope – Gantt Chart

5. SOFTWARE PRODUCT DEVELOPMENT - CONSTRUCTIVE COST MODEL CALCULATIONS

The COCOMO (COnstructive COst MOdel) is a software cost estimation model that can be used to estimate effort, time, and cost required for software development projects. It takes into account various factors such as project size, complexity, team experience, and development process.

The COCOMO model uses a formula to estimate the effort and duration required for a software project based on the number of lines of code.

Following is the result of COCOMO Results for the software development, with following parameters:

- SLOC (Lines of code) - 50,000
- Embedded Mode: A software project that must be developed within a set of tight hardware, software, and operation constraints

COCOMO RESULTS for SmartHome Solutions - AI Innovation

MODE	"A" variable	"B" variable	"C" variable	"D" variable	KLOC	EFFORT, (in person-months)	DURATION, (in months)	STAFFING, (recommended)
embedded	2.84853643404978	1.2	2.5	0.32	50.000	311.448	15.697	19.841

Explanation: The coefficients are set according to the project mode selected on the previous page, (as per Boehm). Note: the decimal separator is a period.

The final estimates are determined in the following manner:

effort = a*KLOC^{b}, in person-months, with KLOC = lines of code, (in thousands), and:

staffing = effort/duration

where a has been adjusted by the factors:

Product Attributes	
Required Reliability	1.15 (H)
Database Size	1.08 (H)
Product Complexity	1.00 (N)
Computer Attributes	
Execution Time Constraint	1.00 (N)
Main Storage Constraint	1.06 (H)
Platform Volatility	1.00 (N)
Computer Turnaround Time	1.00 (N)
Personnel Attributes	
Analyst Capability	0.86 (H)
Applications Experience	0.91 (H)
Programmer Capability	0.86 (H)
Platform Experience	0.90 (H)
Programming Language and Tool Experience	0.95 (H)
Project Attributes	
Modern Programming Practices	0.91 (H)
Use of Software Tools	0.91 (H)
Required Development Schedule	1.04 (H)
New (Values are probably wrong)	
Required reusability	1.05 (H)
Documentation match to life-cycle needs	1.10 (H)
Personnel continuity	1.00 (H)
Multisite development	1.05 (H)

Figure 6 COCOMO Results

The COCOMO model uses a formula to estimate the effort and duration required for a software project based on the number of lines of code. Based on the results, here is the efforts & staffing details

- EFFORT: The estimated effort required for the project is 311.448 person-months.
- DURATION: The estimated duration of the project is 15.697 months.
- STAFFING (recommended): The recommended staffing level for the project is 19.841 people.

Since the business's expectation is to complete the software product development in approximately 13 months, considering activities such as model development, website development, and mobile application development, we need to calculate the staffing based on the desired development duration.

Using the COCOMO calculation provided, the estimated effort is 311.448 person-months, and the desired development duration is 12.9 months (395 days).

To determine the staffing number, we can apply the staffing formula:

Staffing = Effort / Duration

Staffing = 311.448 person-months / 12.9 months ≈ 24.14 people

Therefore, based on the COCOMO calculation and considering the desired development duration of approximately 13 months, the estimated staffing required would be approximately 24.14 people.

It's important to note that the staffing calculation is based on the provided COCOMO model and assumes the accuracy of the effort and duration estimates. Other factors, such as team availability, skill sets, and project risks, should also be considered when finalizing the staffing plan.

6. COST/BUDGET MANAGEMENT

The following cost table outlines the estimates of financial investment required over a span of four years:

Initial investment	Year 0	Year 1	Year 2	Year 3
Initial investment	**$1,900,000**	**$0**	**$0**	**$0**
Implementation costs	**800,000**	**0**	**0**	**0**
Ongoing support costs	**0**	**100,000**	**80,000**	**65,000**
Training costs	**90,000**	**35,000**	**25,000**	**15,000**
Other costs	**0**	**0**	**0**	**0**
Total costs	*$2,790,000*	*$135,000*	*$105,000*	*$80,000*

Table 4 Estimations Outline

The initial investment for Year 0 is $1,900,000, covering the expenses incurred at the beginning of the endeavor. Implementation costs are projected at $800,000 for Year 0 and remain constant at zero for the subsequent years. Ongoing support costs are estimated at $100,000 in Year 1, $80,000 in Year 2, and $65,000 in Year 3. Training costs are expected to amount to $90,000 in Year 0, decreasing gradually to $15,000 in Year 3.

7.1 TOTAL COSTS OVERVIEW

The project involves direct up-front costs, ongoing costs, and indirect costs. Below, our team has addressed all three types of costs to outline the total cost of ownership.

7.1.1 Direct Up-Front Costs

- Research and Development: Costs associated with conducting research, developing AI algorithms, and creating prototypes for smart home products.
- Hardware and Software Investment: Costs of acquiring necessary hardware, such as AI processors or servers, and software licenses for AI development and implementation.
- Training and Skill Development: Costs of training employees or hiring specialized talent to develop and deploy AI technologies within the organization.
- Data Acquisition and Integration: Costs involved in acquiring relevant data sets, ensuring data quality, and integrating data from different sources for AI training and analysis.
- Infrastructure Upgrade: Costs of upgrading existing infrastructure, such as networking systems or cloud computing capabilities, to support AI implementation.

7.1.2 Ongoing Costs

- Maintenance and Upgrades: Costs associated with regular maintenance, software updates, and hardware upgrades to ensure the continued performance and functionality of AI systems.
- Data Management: Costs of data storage, processing, and management required to support AI applications and ensure data availability and accessibility.
- Monitoring and Support: Costs of monitoring AI systems, addressing technical issues, and providing ongoing support to ensure their optimal functioning.
- Training and Skill Development: Ongoing costs of training employees to use and adapt to AI technologies, keeping them up to date with the latest advancements.
- Security and Compliance: Costs of implementing robust security measures, data privacy safeguards, and ensuring compliance with relevant regulations and standards.

7.1.3 Indirect Costs

- Opportunity Cost: The value of potential opportunities or projects that are foregone or delayed due to the allocation of resources and investments in AI innovation.
- Change Management: Costs associated with managing organizational changes, including employee training, cultural shifts, and adapting business processes to leverage AI technology.
- Integration Challenges: Costs incurred in integrating AI systems with existing infrastructure, legacy systems, and ensuring compatibility and seamless operation.
- Legal and Ethical Considerations: Costs associated with legal consultations, compliance assessments, and ethical frameworks to address potential legal and ethical implications of AI implementation.

Other areas involving financial management and control are as follows:

7.1.4 Budget Allocation

- Based on the cost estimation, a comprehensive budget plan has been developed for the project.
- The budget allocates resources to different project phases, including research and development, procurement, implementation, and maintenance.

- Contingency reserves have been included in the budget to account for unforeseen expenses or scope changes.

7.1.5 Cost Monitoring and Control

- Regular monitoring of project costs will be conducted to track the actual expenditures against the budgeted amounts.
- The project manager will compare the actual costs with the allocated budget and analyze any deviations.
- Variances will be documented, and appropriate corrective actions will be implemented to address budget overruns or underspending.

7.1.6 Change Management

- Any proposed changes to the project scope, objectives, or deliverables that may impact on the budget will be carefully assessed.
- Change requests will undergo a thorough evaluation process to determine their feasibility, impact on costs, and alignment with project goals.
- Approved changes will be integrated into the budget and communicated to relevant stakeholders.

7.1.7 Vendor Management

- Vendor selection will be based on a combination of factors, including cost, expertise, reliability, and track record.
- Contracts and service level agreements will be negotiated to ensure cost-effective pricing, clear deliverables, and performance metrics.
- Regular vendor performance evaluations will be conducted to verify compliance with agreed-upon terms and identify opportunities for cost optimization.

7.1.8 Risk Management

- Risks related to cost escalation, budget overruns, and unforeseen expenses will be identified, assessed, and prioritized.
- Mitigation strategies will be developed to minimize the impact of identified risks on the project budget.

- Contingency plans will be established to address risks that may affect cost estimates or the availability of resources.

7.1.9 Reporting

- Regular cost/budget status reports will be generated and shared with key stakeholders.
- The reports will provide an overview of the actual costs incurred, budget utilization, and any significant deviations.
- Recommendations for cost optimization and future budget planning will be included in the reports.

7. QUALITY MANAGEMENT

The Quality Management Plan for the project will outline the strategies and activities to ensure a high-quality product throughout the project lifecycle. The purpose of this plan is to:

- Establish quality planning processes and procedures
- Define quality assurance and control activities
- Set acceptable quality standards and criteria
- Ensure adherence to industry standards and customer satisfaction.

Throughout the project milestones, the following quality management processes will be implemented:

Project Initiation: During this phase, quality objectives and metrics will be defined to establish a clear framework for quality management throughout the project. Quality planning activities, such as identifying quality standards, project constraints, and customer requirements, will be undertaken.

Product Design Phase: Quality will be integrated into the product design process by ensuring that design specifications align with customer needs and industry best practices. Design reviews and validation activities will be conducted to verify that the design meets quality standards and can achieve the desired functionality and performance.

Data Collection and Preparation: To ensure the accuracy and reliability of data used in AI models, robust data collection and preparation processes will be established. Quality checks will be performed to identify and rectify any data issues, such as missing or inconsistent data. Data validation techniques will be employed to ensure the integrity and quality of the collected data.

Model Development: Quality will be a core consideration in the development of AI models. Rigorous testing and validation will be conducted to assess the accuracy, precision, and reliability of the models. Verification activities will be carried out to confirm that the models conform to the specified requirements and produce the expected outputs.

Prototype Development and Testing: The prototypes developed during this phase will undergo thorough testing to validate their functionality, usability, and performance. Various testing techniques, such as functional testing, performance testing, and user acceptance testing, will be employed to identify and address any defects or deviations from quality standards.

Integration and System Testing: As components and subsystems are integrated, comprehensive integration and system testing will be conducted to ensure seamless interoperability and proper functioning of the overall system. Testing will include verifying data exchange, system interfaces, and system behavior to ensure that quality requirements are met.

Web Application Development: Quality assurance practices, including code reviews, unit testing, and user interface testing, will be employed during web application development to ensure high-quality and robust web-based interfaces. Compliance with web standards and accessibility guidelines will also be considered to enhance usability and user experience.

Mobile Application Development: Similar quality management practices will be applied during mobile application development, including testing for compatibility, performance, and security across different mobile platforms. User acceptance testing will be conducted to validate the mobile application's functionality and usability.

Throughout the project, quality control mechanisms, such as quality audits, inspections, and ongoing monitoring, will be employed to ensure adherence to quality standards and the identification of any quality-related issues. Continuous improvement processes, such as lessons learned sessions and corrective actions, will be implemented to enhance project quality, and address any gaps or challenges identified during the project lifecycle.

8. HUMAN RESOURCE MANAGEMENT

The RACI chart is a valuable tool in project management because it provides a clear and structured approach to assigning roles and responsibilities. By clearly defining who is Responsible, Accountable, Consulted, and Informed for each task, the RACI chart ensures that all team members have a clear understanding of their roles and expectations. This promotes accountability, minimizes confusion, and improves decision-making and communication within the project. It enables efficient allocation of resources, prevents tasks from falling through the cracks, and helps to maintain a streamlined workflow. Overall, the RACI framework enhances project efficiency, collaboration, and ultimately increases the likelihood of project success.

Key:

Responsible (R): Designates the team or individual responsible for executing the task.

Accountable (A): Designates the team or individual ultimately accountable and responsible for the task's completion.

Consulted (C): Designates the team or individual whose input and expertise are sought during task execution.

Informed (I): Designates the team or individual who needs to be kept informed about the task's progress or decisions made.

Task	Design Engineers	Project Manager	Data Scientists	Quality Assurance Testers	Software Engineers	Front-end Developers	Back-end Developers	Android Developers	iOS Developers	Marketing Specialists	Sales Team
Data Collection and Preparation		A	R		C					I	
Completion of Product Design	R	A									I
Model Development		A	R							I	
Prototype Testing and Feedback		A	R	R						I	
Integration and System Testing		A	R	R	R					I	
Web Application Development		A				R	R			I	
Mobile Application Development - Android		A						R		I	
Mobile Application Development - Android		A							R	I	
Market the New Service to the Community		A								R	R

Table 5 RACI chart

9.1 STAFFING MANAGEMENT

Staff Acquisition:

The staffing management plan will focus on acquiring the necessary human resources with the relevant skills and expertise. The plan will include strategies for staff acquisition, such as conducting internal job postings to leverage existing talent within the organization and external recruitment to attract individuals with specialized knowledge in areas such as smart home technology, data science, software development, and marketing. The plan will outline the process

for screening and interviewing candidates, including any specific technical assessments or evaluations required. It will also address considerations for diversity and inclusion to ensure a diverse and inclusive project team.

Resource Calendars:

The development and implementation phase are expected to span a duration of 12 months. All resources will be required before the project initiation to ensure a smooth start. During the development phase, four software engineers, two front-end developers, and two back-end developers will be assigned to work intensively for a period of 16 weeks. This dedicated team will focus on coding, testing, and integrating the smart home features into the system. Other resources, such as the project manager, quality assurance testers, and data scientists, will be part of the project management team and will be involved throughout the entire year. Their expertise and guidance will ensure the project's success by overseeing the overall progress, conducting regular quality checks, and making data-driven decisions. By having a well-balanced resource calendar that aligns the availability and allocation of resources with project phases, “SmartHome Solutions” can effectively manage the team's workload, ensure timely deliverables, and maintain a high level of quality throughout the development and implementation process.

Training:

Training is an integral part of the project, ensuring that team members are equipped with the necessary expertise to develop and implement smart home solutions effectively. A thorough training needs assessment will be conducted to identify any skill gaps among the team members. Based on the assessment, a comprehensive training plan will be created, incorporating technical training on smart home technologies, software development methodologies, and customer service skills. Training sessions will be conducted to enhance the team's understanding of the project objectives, industry best practices, and the specific tools and technologies used in the project. By providing targeted training, the project team will be well-prepared to deliver high-quality smart home solutions, ensuring customer satisfaction, and achieving project success.

Performance Reviews:

Performance reviews in the project play a critical role in evaluating the capabilities and contributions of team members. These reviews enable the project manager to assess factors such as task completion, problem-solving skills, communication, and collaboration. By providing

constructive feedback and identifying areas for improvement, performance reviews help enhance individual performance and contribute to the overall success of the project. Additionally, performance reviews facilitate alignment with project goals, identify training and development needs, and foster a culture of continuous improvement, ensuring optimal functionality and efficiency within the project team.

Recognition and Rewards:

For now, the scope of this project does not provide any monetary rewards. However, we plan on implementing unique practices such as innovation awards and gamification elements, we create an environment that encourages creativity and healthy competition. Additionally, offering personal development opportunities and recognizing social impact ensures that team members feel valued and inspired to contribute their best to the project.

- Smart Home Innovation Awards: Recognize team members who contribute innovative ideas and solutions that enhance the functionality and user experience of "SmartHome Solutions" products.
- Smart Home Challenge: Implement a challenge-based reward system where team members are recognized and rewarded for achieving specific milestones or overcoming technical hurdles in the development of smart home products.
- Skill Development Scholarships: Offer scholarships or sponsorships for team members to pursue additional training or certifications in areas relevant to smart home technologies, such as artificial intelligence, IoT, or home automation.
- Smart Home Sustainability Champions: Recognize team members who actively contribute to the development of energy-efficient and eco-friendly smart home solutions. This can include reducing power consumption, optimizing resource usage, or integrating renewable energy sources.
- Smart Home User Experience Awards: Acknowledge team members who excel in creating intuitive and seamless user experiences for "SmartHome Solutions" mobile and web applications.
- Smart Home Hackathon: Organize a hackathon-style event where team members can showcase their creativity and problem-solving skills in developing innovative smart home

features or prototypes. The winners can be rewarded with recognition, prizes, or opportunities to further develop their ideas.

9. COMMUNICATIONS MANAGEMENT

The Communications Management Plan for the project will ensure seamless communication throughout the project lifecycle, promoting collaboration and ensuring project success. It will serve as a comprehensive guide, outlining the strategies, roles, and responsibilities for effective communication.

Communications Management Approach

The Project Manager will take a proactive role in overseeing communication activities, ensuring clear and consistent information flow. The plan will define clear channels and methods for communication, including regular meetings, progress reports, and stakeholder updates. This approach will foster collaboration, alignment, and transparency among project team members and stakeholders.

Communications Management Constraints

All communication activities will be conducted within the approved budget, schedule, and resource allocations. The project manager will ensure that communication tasks are efficiently executed by the project team without relying on external resources. Adherence to established communication frequencies and timelines will be crucial to prevent schedule delays and cost overruns.

Stakeholder Communication Requirement

The project manager will engage with stakeholders to understand their communication preferences and requirements. Personalized communication approaches will be employed to provide relevant and timely updates to each stakeholder. By meeting stakeholders' communication needs, the project team will foster engagement, collaboration, and satisfaction.

Communication Methods and Technologies

The project will leverage various communication methods and technologies to facilitate efficient information exchange. Collaborative tools, such as project management software and shared online platforms, will enable real-time collaboration and document sharing. Regular team meetings, both virtual and in-person, will provide opportunities for face-to-face communication and ensure alignment among project team members.

10.1 COMMUNICATION MATRIX

Communication	Messages	Medium	Frequency	Communicators	Feedback Mechanisms
Kickoff Meeting	Introduce project. Review objectives and goals	Virtual or in-person	Once	Project team and Stakeholders	Email
Requirements Gathering	Gather requirements for smart home solutions	Interviews/Surveys	As needed	Project team, and Customers	Documentation of requirements
Design Review Meetings	Discuss and review technical and creative design aspects	Conference call or Face-to-face	As needed	Technical team and Design team	Document what was updated
Development Updates	Provide updates on development progress	Email	Weekly	Development Team and Project Manager	Email CC the team
User Acceptance Testing	Conduct testing sessions and gather user feedback	In-person sessions or Remote testing	As needed	QA Team and End Users	Bug reports and feedback forms
Marketing and Launch Plan	Discuss marketing strategy and launch plan	Meetings	As needed	Marketing Team and Project Manager	Marketing strategy approval and feedback
Customer Support	Provide customer support for	Online chat, Email, and Phone	Ongoing		Customer feedback and

	smart home solutions			Customer Support Team and Customers	issue resolution
Post-Launch Surveys	Collect feedback through online surveys	Online surveys	After launch	Project Manager and Customers	Survey responses and suggestions

Table 6 Communication Matrix

10. RISK MANAGEMENT

Risk management is the process of identifying, assessing, and mitigating risks that may impact a project, business, or organization. It involves systematically analyzing potential risks, determining their potential impact and likelihood, and developing strategies to address or mitigate them. The goal of risk management is to minimize the negative impact of risks and maximize opportunities for success.

11.1 QUALITATIVE RISK ASSESSMENT USING ONE-MINUTE RISK ASSESSMENT

A "One-Minute Risk Assessment" is a less formal and time-constrained method where people quickly evaluate hazards based on their intuition and knowledge within a condensed amount of time, usually around a minute. It is a quick method for determining prospective risks and the general gravity of those threats.

The One-Minute Risk Assessment approach is a qualitative risk assessment technique that involves quickly assessing risks based on their impact and probability. Here is a streamlined method that includes each step:

Create a thorough inventory of all potential risks that could affect the project by having a brainstorming session to identify them. Think about a variety of things, including technological issues, environmental concerns, organizational issues, and resource-related difficulties.

Analyze probability: Calculate the possibility that each danger you've identified will materialize. Use a numerical scale, such as 1 to 5, or assign categories to the likelihood, such as low, medium, or high.

Impact assessment: Consider the possible effects that each risk, if it were to materialize, may have on the project. Once more, use categories or a numerical scale to evaluate the impact's severity.

Rate Risk: Calculate the risk rating or score by multiplying the likelihood and impact ratings for each risk. Risks can be prioritized according to their relative severity thanks to this grading.

Prioritize risks: List the hazards in ascending order of importance, with greater risk ratings denoting more urgent situations. This prioritization makes it easier to devote the right amount of time and money to mitigating the greatest risks.

The One Minute Risk Assessment is completed as shown below the following process:

On a scale of 1-10, where 1 is low performance and 10 is high performance, rate this project and add the six weighted ratings.

A lower overall project risk score indicates higher project risk.

Range: 10 (most risky) to 100 (least risky).

Overall risk score	10-28	29-46	47-64	65-82	83-100
Project risk level	High	Moderately High	Medium	Moderately Low	Low

Table 7 One minute Risk Assessment Reference Table

Project Characteristic Question	**Rating**	**x**	**Weight**	**=**	**Score**
Data Privacy and Security Risks: How critical is ensuring data privacy and security for the success of the project?	7	x	2	=	14
Bias and Discrimination: How likely is it for biases in AI algorithms to impact the project outcomes?	4	x	1.8	=	7.2
Reliance on Data Quality and Availability: How heavily does the project depend on high-quality and available data?	5	x	1.7	=	8.5
Legal and Regulatory Compliance: How important is it to comply with laws and regulations related to AI?	4	x	1.3	=	5.2
Technical Limitations and Failures: How much could technical limitations and failures impact the project?	8	x	1.1	=	8.8
Dependency on AI Systems: How reliant is the project on AI systems, and how disruptive would it be if they fail?	5	x	0.5	=	2.5
Overall Project Risk Score			46.2		

Table 8 One minute Risk Assessment Score Table

The rationale for the ratings assigned to each project characteristic is described below. Potential actions that could raise those ratings are also described. Even though this is not a software development project, more implementation and customization, all the project characteristics identified as risk factors are applicable:

Data Privacy and Security Risks:

Smart home products handle personal and sensitive data, including user preferences, behavior patterns, and audio/video recordings. Compromising data privacy and security can lead to serious consequences such as privacy breaches, unauthorized access, and even physical risks. Prioritizing and addressing these risks is vital for the project's success. Robust security measures like encryption, access controls, and regular audits are necessary. Establishing data privacy practices, including proper data collection, storage, and governance, is essential for protecting user information and complying with regulations.

Bias and Discrimination:

Bias in AI algorithms can occur when the training data used to develop the algorithms is itself biased or reflects existing societal biases. If biases exist in the data, the AI algorithms may learn and perpetuate those biases, leading to unfair outcomes or discriminatory behavior.

To assess the likelihood of biases impacting the project outcomes, it is important to evaluate the quality and diversity of the training data used, the steps taken to mitigate biases during algorithm development, and the ongoing monitoring and evaluation of the algorithms' performance for potential biases.

Reliance on Data Quality and Availability:

High-quality and available data is critical for the success of the project. Relying on low-quality or inaccessible data increases the risk of errors and flawed results. Inaccurate or biased data can lead to incorrect predictions and unreliable insights. Insufficient or delayed data availability can cause delays, disrupt the project timeline, and hinder decision-making. The risk extends beyond immediate outcomes, potentially impacting the project's reputation and long-term success. To mitigate these risks, robust data collection, storage, and management practices should be established, including data quality control, privacy, and security measures. Strategies for ensuring data availability when needed are important, and regular monitoring and evaluation of data sources and management processes are crucial. Managing the risk associated with data quality and availability enhances project outcomes and delivery.

Legal and Regulatory Compliance:

Compliance with laws and regulations related to AI is of paramount importance in home product projects. It ensures the protection of user rights, such as privacy and consent, while mitigating risks associated with data breaches and algorithmic biases. By complying, companies build consumer

trust and safeguard their reputation. Compliance also enables access to international markets and fosters responsible innovation. Overall, it upholds ethical principles, protects user privacy, and ensures the long-term success and sustainability of home product projects.

Technical Limitations and Failures:

Technical limitations and failures can have a significant impact on a home products project, affecting functionality, performance, user experience, and overall project success. They can lead to dissatisfied customers, decreased user adoption, and damage to the project's reputation. Mitigating these impacts requires rigorous testing, quality assurance, and prompt troubleshooting. By addressing technical limitations and failures proactively, companies can ensure a reliable product, meet user expectations, and maintain a positive brand reputation, leading to increased customer satisfaction and market adoption.

Dependency on AI Systems:

The home products project is reliant on AI systems, and their failure could have disruptive consequences. The project's functionality and user experience may be compromised, leading to negative reviews, decreased customer satisfaction, and potential loss of market share. To mitigate the impact of AI system failures, contingency plans, backup mechanisms, and proactive monitoring are crucial to ensure the project's success and minimize disruptions.

11.1.1 Conclusion

The One Minute Risk Assessment indicates that the project has a moderately high-risk level, falling within the range of 29-46. Risks include data privacy and security, biases in AI algorithms, reliance on data quality and availability, legal compliance, technical limitations and failures, and dependency on AI systems. Mitigation strategies should focus on robust security measures, addressing biases, ensuring data quality, complying with regulations, addressing technical limitations, and developing contingency plans. Implementing these strategies will enhance project success and protect user privacy.

11.2 QUANTITATIVE RISK ASSESSMENT USING MONTE-CARLO SIMULATION

The goal of this Monte Carlo simulation is to study what might happen in a project and the chances of different outcomes. We used statistical methods to figure out the possible range of results and the likelihood of achieving specific goals. The simulation considered things like task relationships and how each task can vary, giving us a complete picture of how the project might perform.

Task	Optimistic Time (In Days)	Expected Time (In Days)	Pessimistic Time (In Days)
Project Initiation	12	15	20
Product Design Phase	160	170	180
Data Collection and Preparation	50	55	60
Model Development	120	125	130
Prototype Development and Testing	55	60	65
Integration and System Testing	90	95	100
Web Application Development	40	45	50
Mobile Application Development	65	70	75
Total	**592**	**635**	**680**

Table 9 Monte Carlo Simulation Project Outline

11.2.1 Results

The Monte Carlo simulation was performed with a total of 2,500 trials to assess the risk associated with the project. The simulation yielded valuable insights into the likely outcomes based on the provided statistics.

The average value obtained from the simulation was 370.00, indicating the expected mean outcome for the project. However, it is important to note that the actual results may deviate from this value due to inherent uncertainties.

The standard deviation of 20.00 signifies the spread or variability of the results around the mean value. A higher standard deviation suggests a wider range of potential outcomes, highlighting the project's inherent risk.

The median value of 360.00 represents the middle value in the distribution of results. It divides the dataset into two equal halves, suggesting that half of the simulated outcomes were below 360.00 and the other half were above this value.

The lowest observed value in the simulation was 320.00, indicating the possibility of achieving outcomes lower than the expected mean. Conversely, the highest observed value was 440.00, representing the potential for favorable outcomes exceeding the mean value.

To assess the likely range of outcomes, percentile ranges were used. The P80 range, which captures 80% of the results, was determined to be between 340.00 and 390.00. This range eliminates extreme values and provides a more realistic understanding of the project's potential outcomes.

Additionally, the P50 range, representing the 25th to 75th percentile, was found to be between 350.00 and 380.00. This range offers further insights into the middle 50% of the results, encompassing a narrower band of likely outcomes.

These results indicate that the project carries inherent uncertainty and risk. Stakeholders should consider the potential for outcomes both above and below the expected mean value, considering the provided percentile ranges to understand the most likely outcomes.

Simulation Trials	2,500.00
Mean (Average) Value	370.00
Standard Deviation	20.00
Median Value	360.00
Lowest Observed Value	320.00
Highest Observed Value	440.00
P80 Range (10th - 90th percentile)	340.00 - 390.00
P50 Range (25th - 75th percentile)	350.00 - 380.00

Figure 7 Project Statistics

The contribution to variance, also known as single-factor sensitivity, measures the impact of each individual task on the overall project result. It quantifies how much variability in the project can be attributed to the variability in each specific task.

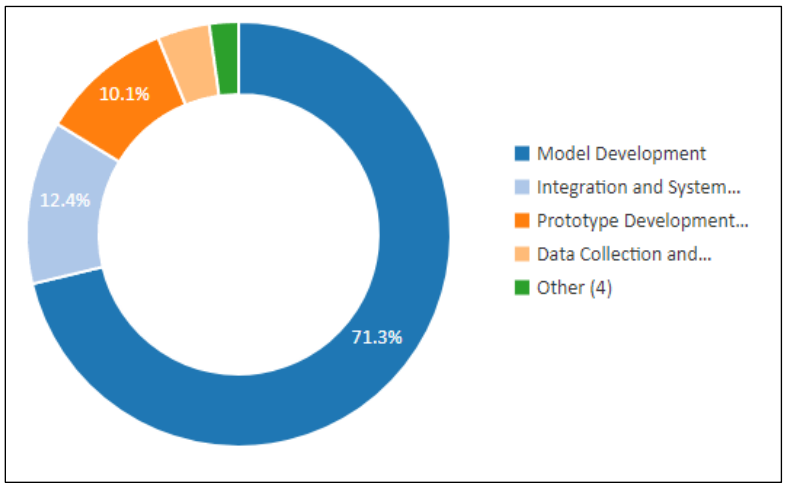


Figure 8 Contribution to Variance

The analysis revealed that ***Model Development*** had the highest contribution to the overall project variance, accounting for 69.8% of the variability. This suggests that any changes or uncertainties in the ***Model Development*** task would have a significant impact on the overall project outcome.

Integration and System Testing followed with a contribution to variance of 15.3%, indicating that variations in this task had a moderate effect on the overall project variance.

Prototype Development & Testing accounted for 9.4% of the overall project variance, indicating a relatively lower but still noteworthy impact on the project outcome.

Overall, this Monte Carlo simulation provided valuable insights into the relative contributions of different tasks to the project's variance. These results can help to prioritize risk mitigation strategies and allocate resources effectively to minimize potential disruptions and uncertainties in the project.

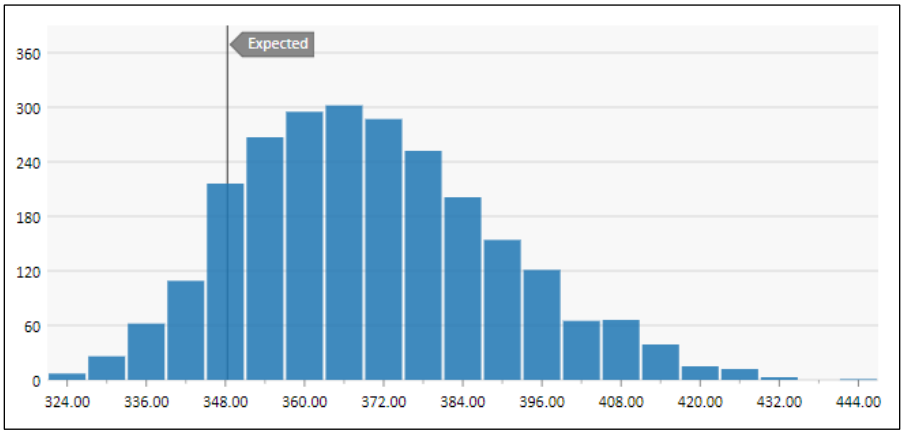


Figure 9 Distribution of Outcomes

The above histogram illustrates the frequency at which each outcome occurred during the simulation.

The x-axis of the histogram represents the possible outcomes, while the y-axis indicates the frequency or number of occurrences. The histogram provides insights into the range of potential project outcomes and their respective likelihoods.

Based on the simulation, the expected value for the overall project is estimated to be 350.00. This value represents the average or most likely outcome.

In addition to the expected value, the simulation also determined the optimistic and pessimistic values for the project. The optimistic value is 444.00, indicating the best-case scenario. Conversely, the pessimistic value is 240.00, representing the worst-case scenario.

By analyzing the histogram, it is possible to assess the likelihood of achieving certain outcomes within the project. The histogram suggests that outcomes between 324.00 and 420.00 are relatively common, while outcomes beyond this range become increasingly less frequent.

The distribution of outcomes provides a visual representation of the project's potential risks and uncertainties. It allows risk managers to gain a comprehensive understanding of the project's range of possibilities and make informed decisions regarding risk mitigation strategies.

Expected Value	350.00
Probability of Result <= Expected Value	20.8%
10% Overrun (Expected + 10%)	385.00
Probability	82.2%
25% Overrun (Expected + 25%)	437.50
Probability	100.0%

Figure 10 Project Probabilities

The expected value for the project, which is calculated based on the expected value for all tasks and their dependencies, was determined to be 350.00.

The simulation results indicate that there is a 20.8% probability that the project will be completed on schedule or before the expected value. This implies that there is a moderate chance of meeting the project deadline or even completing it ahead of schedule.

Furthermore, the simulation also provided insights into the probabilities of cost overruns. With a 10% overrun, where the expected value is increased by 10%, the probability of the result being less than or equal to 385.00 was found to be 82.2%. This suggests a relatively high likelihood of staying within the budget, considering a small overrun.

Additionally, when considering a 25% overrun, with the expected value increased by 25%, the simulation results indicate a 100.0% probability of the result being less than or equal to 437.50. This implies that the project is highly likely to be completed within the budget even with a larger overrun.

11.2.2 Recommendation

Based on the results obtained from the Monte Carlo simulation, several recommendations can be made to effectively manage the risks associated with the project:

Consider the range of potential outcomes: The simulation revealed a wide range of potential outcomes, with results varying above and below the expected mean value of 370.00. Stakeholders should acknowledge the possibility of both favorable and unfavorable outcomes and develop contingency plans accordingly.

Focus on risk mitigation for Model Development: As the task with the highest contribution to the overall project variance (69.8%), special attention should be given to managing risks associated with Model Development. Proactive risk mitigation strategies, thorough planning, and close monitoring of this task are crucial to reducing the overall project uncertainty.

Allocate resources and monitor Integration and System Testing: With a contribution to variance of 15.3%, Integration and System Testing play a significant role in determining project outcomes. Proper resource allocation, effective coordination, and rigorous testing procedures should be implemented to minimize variations in this task and ensure smooth integration of project components.

Mitigate risks in Prototype Development & Testing: While accounting for 9.4% of the overall project variance, Prototype Development & Testing still holds a notable impact on project outcomes. Identifying and addressing potential risks in this area can help prevent delays, defects, or deviations from project objectives.

Use percentile ranges for planning: The provided percentile ranges (P80 range: 340.00 to 390.00, P50 range: 350.00 to 380.00) offer insights into likely project outcomes. By incorporating these ranges into planning and decision-making processes, stakeholders can set realistic expectations, establish appropriate milestones, and allocate resources accordingly.

Continuously monitor and adapt: Risk management is an ongoing process. Regular monitoring of project progress, reassessment of risks, and adaptation of risk mitigation strategies are essential to address emerging challenges effectively. Proactive risk management enables timely interventions and helps prevent potential disruptions.

Communicate and involve stakeholders: Effective communication with stakeholders is crucial in risk management. Keeping stakeholders informed about potential risks, uncertainties, and mitigation strategies fosters collaboration, facilitates decision-making, and promotes a shared understanding of project risks.

11.3 RISK RESPONSE PLAN

The table below outlines our planned responses to the risks identified in the risk management section of the business case proposal. Each risk has a trigger, which indicates when the risk occurs and alerts the designated owner responsible for monitoring and addressing the risk. Our responses are based on one of the four fundamental risk strategies:

a. Accept or Ignore: We acknowledge the risk but decide to take the chance of negative impact, factoring in potential budget costs.
b. Avoidance: We modify our plans to circumvent the problem and prevent the risk from materializing.
c. Mitigate: We implement intermediate steps to reduce the impact or likelihood of the risk.
d. Transfer: We outsource the risk (or a portion of it) to a third party that can manage the outcome.

The chosen response will depend on the situation, and we must ensure that sufficient resources are available for the selected response. If resources are insufficient, we may have to consider changing our plan entirely, which could have significant implications for the company.

Task	Risk	Trigger	Owner	Response
Define project objectives, scope, and deliverables	Lack of clear project objectives, scope, and deliverables	Initiating a new project or project planning phase	Project Manager	Facilitate discussion with stakeholders to define clear objectives, scope, and deliverables
Identify project team members and stakeholders	Insufficient or inappropriate team members or stakeholders	Initiating a new project or project planning phase	Project Manager	Conduct stakeholder analysis and identify appropriate team members and stakeholders
Conduct market research and competitor analysis	Inaccurate or incomplete market research data	Initiating a new project or project planning phase	Marketing Specialist	Employ rigorous data collection and analysis methods to gather accurate and comprehensive market research and competitor data
Gather user requirements and preferences	Incomplete or inaccurate understanding of user needs and preferences	Initiating a new project or project planning phase	Product Manager	Conduct user research and engagement activities to gather comprehensive and accurate user requirements and preferences

Create initial product design concept	Lack of alignment with user needs and market trends	Completion of user requirements gathering	Design Engineers	Conduct market analysis and user-centric design process to create a product design concept aligned with user needs and market trends
Iterate and refine product design based on feedback	Insufficient or conflicting user feedback	Completion of initial product design concept	Front-end Developers	Gather user feedback through usability testing and surveys, analyze feedback, and iterate the product design based on user input
Production	Technical Limitations and Failures	Completion of iterative design and development phases	Development Team	Implement the final product based on the refined design and ensure technical stability and performance
Identify necessary data sources and collection methods	Data Privacy and Security Risk	Lack of data privacy measures	Data Scientist	Develop data privacy and security protocols

Collect relevant data for product development	Data Privacy and Security Risks	Insufficient data availability	Data Scientist	Implement data privacy and security measures
Organize and prepare collected data for analysis	Data Privacy and Security Risks	Data breaches or unauthorized access	Data Scientist	Implement data privacy and security measures
Select appropriate technologies and build frameworks	Technical Limitations	Incompatibility with existing systems	Technical Lead	Conduct feasibility assessments
Develop algorithms and models for smart home functionalities	Bias and Discrimination	Data bias and discrimination in algorithms	Data Scientist	Implement fairness and bias mitigation strategies
Train and refine the models based on collected data	Bias and Discrimination	Insufficient data quality or biased training data	Data Scientist	Implement fairness and bias mitigation strategies
Build a functional prototype incorporating the developed models	Technical Limitations	Inadequate AI system performance	Software Engineer	Test and optimize the prototype for performance and limitations
Conduct testing to validate the prototype's functionality	Technical Limitations	AI system failures or errors	Quality Assurance Testers	Identify and address technical limitations and failures
Gather user feedback on the prototype's usability and performance	Inadequate or biased user feedback	Completion of prototype development phase	Quality Assurance Testers	Collect user feedback and analyze usability

				and performance
Iterate and refine the prototype based on feedback	Failure to address user needs and preferences	Completion of user feedback gathering on the prototype	Software Engineers	Analyze user feedback, identify areas for improvement, and implement changes to the prototype to address user needs and preferences
Integrate the prototype with necessary hardware and software components	Technical Limitations	Incompatibility or issues with hardware or software	Software Engineer	Ensure compatibility and seamless integration
Conduct system-level testing to ensure seamless connectivity and interoperability	Technical Limitations	Integration issues or failures	Quality Assurance Testers	Identify and address integration issues and bugs
Identify and resolve any Integration issues or bugs	Technical Limitations	Integration issues or failures	Software Engineer	Investigate and address integration issues or bugs
Define the architecture and design of the web application	Technical Limitations	Completion of initial requirements gathering	Front-end and Back-end Developers	Conduct a comprehensive analysis of requirements, design the architecture, and create a detailed

				design plan for the web application
Develop the '1st draft' of the website, incorporating smart home control features	Technical challenges in integrating smart home control features	Completion of web application architecture design	Front-end and Back-end Developers	Implement the initial version of the website with smart home features
Conduct user testing and gather feedback on the web application	Inadequate or biased user feedback	Completion of the first draft of the web application	Front-end and Back-end Developers	Conduct user testing and collect feedback on usability
Iterate and refine the web application based on feedback	Failure to address user needs and improve user experience	Completion of user testing and feedback gathering	Development Team	Analyze user feedback, identify areas for improvement, and implement changes to the web application to address user needs and enhance user experience
Define the architecture and design of the mobile applications (Android and iOS)	Technical Limitations	Completion of initial requirements gathering	Technical Lead	Design a scalable and efficient mobile application architecture

Develop the 1st version of the Android application with smart home control features	Technical challenges in integrating smart home control features on Android	Completion of mobile application architecture design	Android Developer	Implement the initial version of the Android application with smart home features
Develop the 1st version of the iOS application with smart home control features	Technical challenges in integrating smart home control features on iOS	Completion of mobile application architecture design	iOS Developer	Implement the initial version of the iOS application with smart home features
Conduct user testing and gather feedback on the mobile applications	Inadequate or biased user feedback	Completion of the 1st version of the mobile applications	Front-end and Back-end Developers	Conduct user testing and collect feedback on usability and performance
Iterate and refine the mobile applications based on feedback	Failure to address user needs and improve user experience	User feedback indicating usability or functionality issues	Product Manager	Incorporate user feedback and make necessary improvements

Table 10 Risk Response Plan

Appendix A: Project Management Plan Approval

The undersigned acknowledge they have reviewed the *SmartHome Solutions - Innovation* **Project Management Plan** and agree with the approach it presents. Changes to this **Project Management Plan** will be coordinated with and approved by the undersigned or their designated representatives.

Signature:		Date:	07/05/23
Print Name:	Tsuneo Leavitt		
Title:	Project Manager		
Role:			

Signature:		Date:	07/05/23
Print Name:	Ansbert Cermak		
Title:	Implementation Manager		
Role:			

Signature:		Date:	07/05/23
Print Name:	Sebastian Jelen		
Title:	Implementation Manager		
Role:			

APPENDIX B: REFERENCES

The following table summarizes the documents referenced in this document.

Document Name and Version	Description	Location
Monte Carlo Methods	An explanation of Monte Carlo simulation	https://www.riskamp.com/smart/app/project/#overview
Infographic: How Many Lines of Code Is Your Favorite App?	An explanation of How Many Lines of Code Is Your Favorite App?	www.fastcompany.com/3021256/infographic-how-many-lines-of-code-is-your-favorite-app
STRS COCOMO Calculation	Calculation related to COCOMO	strs.grc.nasa.gov/repository/forms/cocomocalculation/.

APPENDIX C: KEY TERMS

The following table provides definitions for terms relevant to this document.

Term	Definition
Project Stakeholders	Individuals or groups who have a vested interest in the success of the project, including the project sponsor, senior leadership, and the project team.
COCOMO (COnstructive COst MOdel)	A software cost estimation model that helps estimate the effort, time, and cost required for software development projects. It considers factors such as project size, complexity, team experience, and development process to provide estimates based on lines of code.
Direct Up-Front Costs	Expenses incurred at the beginning of the project, including research and development costs, hardware and software investments, training and skill development expenses, data acquisition and integration costs, and infrastructure upgrade expenses.
Ongoing Costs	Continuous expenses associated with the project's operation and maintenance, including costs for maintenance and upgrades, data management, monitoring and support, ongoing training and skill development, and security and compliance measures.
Indirect Costs	Costs that are not directly associated with project activities but have an impact on the project's overall financial management. These costs may include opportunity costs, change management expenses, integration challenges, and legal and ethical considerations.