**1. Executive Summary**

SNEA (Simple Network Engine Assistant) is a conversational AI chatbot designed to provide banking information and assistance through a user-friendly interface. This personal project aims to create a functional chatbot similar to HDFC EVA while leveraging Firebase, Dialogflow, and other modern tools to deliver a seamless user experience.

The project will be developed following an agile methodology with a one-week timeline for the minimum viable product (MVP). This comprehensive BRD outlines the business requirements, technical specifications, architectural design, and implementation approach to guide development. It serves as both a project roadmap and technical documentation for future reference or potential expansion.

By combining cloud-based services with conversational AI capabilities, SNEA will demonstrate how modern tools can be leveraged to create intelligent customer service solutions. The document includes detailed module breakdowns for sprint planning, algorithmic approaches, technical architecture, and a comprehensive tech stack analysis to ensure reusability and extensibility of the developed components.

**2. Project Overview**

**2.1 Background**

Banking chatbots like HDFC EVA have revolutionized customer service in the financial sector by providing instant access to information and assistance through conversational interfaces. These virtual assistants help customers with account inquiries, transaction details, product information, and general banking guidance without requiring human intervention for routine matters. This shift has improved customer satisfaction while reducing operational costs for banking institutions.

This project seeks to build a similar capability as a learning exercise and personal project, incorporating practical skills in cloud services, conversation design, and workflow automation. By implementing SNEA, we aim to understand the architectural and technical considerations of building a conversational AI system while creating a portfolio-worthy demonstration of these capabilities.

**2.2 Objectives**

The primary objectives of the SNEA project are to:

* Create a functional banking chatbot with natural language understanding capabilities that can recognize and respond to common banking queries with human-like conversation.
* Implement core features that demonstrate capabilities similar to banking assistants including account information retrieval, product explanations, and service guidance.
* Learn and apply Firebase, Dialogflow, and n8n technologies in a practical context to understand their integration points and capabilities.
* Follow proper software development lifecycle practices including requirements gathering, design, implementation, testing, and documentation.
* Document the development process for future reference with comprehensive technical specifications and architectural decisions.
* Build a portfolio-worthy project demonstrating conversational AI skills that could be presented to potential employers or clients.
* Create reusable components that could be applied to future projects or extended for more complex implementations.
* Establish a foundation for potential expansion into more advanced banking assistant capabilities.

**2.3 Success Criteria**

The SNEA project will be considered successful if it achieves the following outcomes:

* SNEA correctly responds to at least 90% of test queries within defined conversation flows, demonstrating appropriate understanding of user intent and context.
* User interface is responsive and accessible across devices with a clean, intuitive interaction model and minimal response latency.
* Chatbot can handle basic banking information requests including account status queries, product information, and service details using simulated data.
* Project is completed within the one-week timeline with all core modules functional and tested.
* Code and documentation are well-structured for future enhancements with clear architectural patterns and development guidelines.
* Integration of at least one workflow automation using n8n that demonstrates potential for backend process integration.
* Clear documentation of architecture and conversation design that explains implementation decisions and technical approaches.
* Project can be demonstrated to showcase technical capabilities with a smoothly functioning end-to-end user experience.
* Reusable components are identified and documented for potential use in future projects.
* Technical implementation follows best practices for security, performance, and maintainability within the constraints of the timeline.

**2.4 Scope**

**In Scope:**

The SNEA project will include the following capabilities and components:

* Development of conversational AI using Firebase and Dialogflow to create a natural language understanding system capable of recognizing common banking queries and extracting relevant entities.
* Implementation of static responses for banking information including account types, loan products, credit cards, fees, and interest rates.
* Basic user interface for chatbot interaction with text input/output, quick reply options, and structured information display.
* Integration with n8n for workflow automation to demonstrate the potential for process automation and external system integration.
* Documentation of development process and architecture including technical specifications, conversation flows, and integration patterns.
* User authentication and session management to personalize interactions and maintain conversation context.
* Simulated account data for demonstration purposes that illustrates how actual banking data would be presented.
* Banking product information (accounts, loans, credit cards) with features, benefits, and application requirements.
* Service location information (branches, ATMs) with basic search capabilities using predefined locations.
* FAQ handling for common banking queries with appropriate responses and follow-up suggestions.
* Simple analytics for conversation tracking to measure interaction effectiveness and popular topics.
* Implementation of reusable components with documentation for future development.
* Architectural foundation for potential extensions and improvements.

**Out of Scope:**

The following capabilities are explicitly excluded from the initial SNEA implementation:

* Integration with actual banking systems for real account information or transactions.
* Real user authentication with banking credentials or financial know-your-customer (KYC) verification.
* Production-level security measures beyond basic authentication and data protection.
* Mobile app development (web-based interface only) as a native application would expand the timeline significantly.
* Multi-language support (English-only for initial release) to maintain focus on core functionality.
* Advanced personalization based on user history or preferences beyond basic session context.
* Real-time transaction processing or payment initiation capabilities.
* Integration with payment gateways or financial processing systems.
* Voice interface (text-only for initial release) as speech recognition would add complexity.
* Customer support ticketing system integration for escalation management.
* Regulatory compliance features for financial services beyond basic disclaimers.
* Advanced analytics and reporting beyond basic conversation tracking.
* Machine learning capabilities beyond those provided by Dialogflow.
* Biometric authentication methods.

**3. Stakeholders**

**3.1 Primary Stakeholder**

The primary stakeholder for the SNEA project is:

* **Project Owner/Developer: Sneha AJITHKUMAR**  
   As the project owner and developer, Sneha will be responsible for all aspects of the project from requirements gathering through implementation and documentation. She will make all key decisions regarding technical approach, design choices, and feature prioritization. The project serves as both a learning opportunity and portfolio piece for her.

**3.2 Secondary Stakeholders**

Secondary stakeholders who have an interest in the project outcomes include:

* **Ajithkumar KUMARAN** As a collaborator or advisor, Ajithkumar may provide input on technical decisions, review progress, and offer feedback throughout the development process.
* **Future users of the chatbot** Though this is primarily a personal project, potential users represent a stakeholder group whose needs should be considered in the design and implementation of the chatbot interface and functionality.
* **Developers interested in similar projects** The documentation and code may serve as a reference for other developers undertaking similar projects, making the technical choices and architecture important for educational purposes.
* **Potential portfolio reviewers** Employers, clients, or other professionals who might review the project as part of a portfolio assessment represent a stakeholder group with interest in the quality of implementation, documentation, and problem-solving approaches demonstrated.

**4. Functional Requirements**

**4.1 Conversation Capabilities**

**4.1.1 Basic Conversation**

The foundation of SNEA's functionality is its ability to engage in natural conversation with users. This capability includes:

**Greeting and Introduction**

SNEA will welcome users with a friendly, professional greeting that establishes the chatbot's identity and purpose. The introduction will briefly explain SNEA's capabilities and suggest ways the user might begin the conversation. The greeting will adapt to recognize returning users versus new interactions, and support various greeting inputs (hello, hi, hey, etc.) with appropriate responses.

The conversation initiation will include:

* Welcome message with SNEA identification
* Brief overview of capabilities
* Suggestion chips for common starting points
* Option to type a free-form question

**Small Talk Management**

Beyond task-oriented conversation, SNEA will handle casual conversation elements that humanize the interaction. This includes appropriate responses to pleasantries, gratitude expressions, and casual questions. While not the primary focus, these capabilities maintain conversation flow and prevent frustration when users employ natural conversation patterns.

**Small talk capabilities include:**

* Responding to greetings and farewells
* Acknowledging gratitude expressions
* Brief responses to personal questions about the chatbot
* Professional handling of casual comments

**Help and Guidance**

When users are unsure how to proceed or what capabilities are available, SNEA will provide clear guidance on available features and how to interact effectively. This guidance system serves as an in-conversation user manual that adapts to the user's current context and previous interactions.

**Help functionality includes:**

* Explanation of available features and services
* Example questions the chatbot can answer
* Navigation assistance through menu options
* Topic suggestions based on popular queries
* Guidance back to main topics when conversation diverges

**Context Management**

To create a cohesive conversation experience, SNEA will maintain contextual awareness across multiple interaction turns. This allows users to ask follow-up questions without repeating all details and enables the chatbot to provide more relevant responses based on the conversation history.

**Context management features include:**

* Maintaining active topics across multiple messages
* Remembering referenced entities (accounts, products)
* Supporting pronoun resolution for follow-up questions
* Allowing context switching while preserving previous context
* Managing context lifespan appropriately

**4.1.2 Banking Information**

A core function of SNEA is providing accurate information about banking products and services. This capability forms the knowledge base that powers most user interactions.

**Account Types Information**

SNEA will provide comprehensive information about various account types offered by banks. This information will be structured to address common questions about features, benefits, requirements, and comparison points between account types.

For each account type, SNEA can explain:

* Key features and benefits
* Minimum balance requirements
* Fee structures and conditions
* Interest rates and calculation methods
* Documentation requirements for opening
* Eligibility criteria
* Digital banking capabilities
* Comparison with other account types

**Loan Information**

Loan products represent complex financial instruments that often require detailed explanation. SNEA will provide information about common loan types, their features, application processes, and requirements.

**Loan information capabilities include:**

* Personal, home, vehicle, and education loan details
* Interest rate information and calculation methods
* Repayment terms and options
* Eligibility criteria and documentation
* Application processes and timelines
* EMI calculation explanation
* Prepayment and foreclosure terms
* Collateral requirements where applicable

**Credit Card Information**

Credit cards have distinct features, benefits, and terms that consumers need to understand. SNEA will provide detailed information about credit card options, rewards programs, and usage considerations.

**Credit card information includes:**

* Card types and their target demographics
* Annual fees and charges
* Reward points systems and redemption options
* Cashback programs and special offers
* Interest rates and billing cycles
* Credit limits and enhancement processes
* International usage policies
* Insurance and protection benefits

**Fees and Charges**

Banking services often come with various fees and charges that customers need to understand. SNEA will provide clear information about common banking fees, when they apply, and how they might be avoided.

**Fee information includes:**

* Account maintenance charges
* Transaction fees (ATM, IMPS, RTGS, NEFT)
* Minimum balance non-maintenance penalties
* Debit/credit card annual fees
* Loan processing fees
* Checking charges and statement fees
* Online/mobile banking charges
* Late payment penalties

**Interest Rates**

Interest rates are a critical factor in financial decision-making. SNEA will provide current interest rate information for various banking products and explain how interest calculations work.

**Interest rate information includes:**

* Savings account interest rates
* Fixed deposit rates for various tenures
* Loan interest rates (floating and fixed)
* Credit card interest calculation
* Compound interest explanations
* Tax implications of interest income
* Rate comparison between products
* Historical rate trends (simplified)

**4.1.3 Account Information (Simulated)**

To demonstrate how a production banking chatbot would handle personal financial information, SNEA will include simulation capabilities for account-related queries.

**Balance Inquiries**

SNEA will respond to balance inquiries with simulated data that demonstrates how actual account information would be presented. This simulation will include appropriate security acknowledgments and data presentation formats.

**Balance inquiry features include:**

* Available balance display for simulated accounts
* Multiple account type support (savings, current, credit card)
* Balance breakdown (available vs. holding)
* Mini statement option with recent transactions
* Clear indication that data is simulated
* Balance trend visualization (textual)

**Transaction History**

Transaction history provides insight into account activity over time. SNEA will simulate transaction history responses with realistic transaction types, descriptions, and amounts.

**Transaction history features include:**

* Recent transaction listing with dates and amounts
* Transaction categorization (spending categories)
* Search/filter capability by date range or type
* Transaction detail expansion
* Spending pattern observations
* Downloadable statement explanation (simulated)

**Statement Information**

Account statements are formal records of financial activity. SNEA will explain statement features, access methods, and interpretation guidelines.

**Statement information includes:**

* Statement generation process explanation
* Statement period and delivery options
* Statement format explanation and sample
* E-statement registration process
* Statement archival and retrieval information
* Understanding statement components guidance

**4.1.4 Service Information**

Beyond product and account information, banking customers often need information about operational aspects of banking services.

**Product Application Procedures**

SNEA will provide step-by-step guidance on application procedures for various banking products and services, explaining the process, requirements, and timelines.

Application procedure information includes:

* Account opening procedures (online and branch)
* Loan application processes and stages
* Credit card application methods
* Required documentation explanation
* Processing timelines and expectations
* Application status checking methods
* Common application issues and resolutions

**Documentation Requirements**

Banking services typically require identity verification and supporting documentation. SNEA will provide detailed information about documentation requirements for various services.

**Documentation information includes:**

* **I**dentity proof requirements (acceptable documents)
* Address proof documentation options
* Income proof requirements for credit products
* KYC process explanation
* Document verification procedures
* Special requirements for specific products
* Digital document submission guidelines

**Location Services**

Physical banking locations remain important for many services. SNEA will provide information about branch and ATM locations using simulated location data.

Location service information includes:

* Branch locations with addresses and contact numbers
* ATM locations and available features
* Branch operating hours and special timings
* Services available at specific locations
* Accessibility information
* Appointment booking guidance
* Location search by area/pincode (simulated)

**Customer Service Details**

When users need assistance beyond what the chatbot can provide, SNEA will offer appropriate customer service contact information and escalation paths.

Customer service information includes:

* Contact numbers for various departments
* Email addresses for specific queries
* Social media support channels
* Complaint registration procedures
* Feedback submission methods
* Escalation matrix for unresolved issues
* Expected response times

**4.2 User Experience**

**4.2.1 Interface Requirements**

The user interface is critical to providing an engaging and effective chatbot experience. SNEA's interface will balance simplicity with functionality to create an intuitive user experience.

**Chat Interface Design**

The core of the user experience is the chat interface itself, which must facilitate natural conversation while providing appropriate visual structure and feedback.

**The chat interface will feature:**

A clean, minimalist design that focuses attention on the conversation itself while providing necessary context and controls. Messages will be clearly attributed with visual distinction between user and bot responses, including timestamps for reference and conversation flow understanding. Typing indicators will display when SNEA is preparing responses to set appropriate user expectations, particularly for complex queries requiring longer processing times.

The interface will support rich content display within the conversation stream, allowing for formatted text, tables, images, and interactive elements while maintaining a cohesive conversation experience. Message grouping will combine related information for readability while avoiding overwhelming message blocks.

The conversation history will be persistent within a session with smooth scrolling capabilities and a "load more" function for longer conversations. Users will have the ability to reference previous parts of the conversation easily, supporting the natural flow of human dialogue which often refers back to earlier statements.

**Quick Reply Options**

To streamline common interactions and guide users toward successful outcomes, SNEA will implement contextual quick reply options throughout conversations.

**Quick reply options will include:**

Contextually relevant suggestion buttons that appear after bot responses, offering logical next steps based on the current conversation state. These buttons will accelerate the conversation flow by minimizing typing for common responses while still allowing free-form input for complex queries.

Common query shortcuts will provide one-click access to frequently asked questions within the current context, such as "Check balance" or "See transactions" when discussing accounts. Category navigation buttons will help users explore major service areas quickly, functioning as a visual menu system embedded within the conversation.

For confirmation queries, simple yes/no options will streamline decision points while more complex choices will present clearly labeled options that balance brevity with clarity. All quick reply options will be designed for touch interaction on mobile devices while remaining keyboard-accessible for desktop users.

**Visual Information Display**

While conversation is the primary interaction mode, visual elements will enhance information clarity for complex or structured data.

**Visual information elements will include:**

Rich cards for product information that combine images, key details, and action buttons in a compact, scannable format. These cards will help users quickly grasp product features and benefits while maintaining the conversation context.

Tabular data will present fee structures, interest rates, and comparison information in a structured format that facilitates understanding of complex relationships between data points. For multiple options or products, carousel displays will allow horizontal scrolling through alternatives with consistent presentation.

Transaction history and account information will use structured list views with appropriate typography and color-coding to highlight important information. Visual hierarchy within these displays will guide attention to key information while providing access to details on demand.

All visual elements will be designed for responsive display across device sizes with appropriate scaling and reorganization based on available screen space.

**Responsive Design**

SNEA's interface must function effectively across a range of devices from mobile phones to desktop computers.

The responsive design approach includes:

A fluid layout that adapts to screen sizes from 320px to 2560px width, ensuring all content and functionality remains accessible regardless of device. The interface will prioritize content and controls differently based on available space, ensuring the most important elements are always readily accessible.

Touch-friendly design elements will accommodate finger interaction on mobile devices with appropriate target sizes and spacing, while still supporting precise mouse **interaction on** desktops. Font sizes and line heights will adjust across devices to maintain readability without requiring horizontal scrolling.

Media and visual elements will load appropriately for the user's connection speed and device capabilities, with optimized assets for different screen resolutions. The layout will work effectively in both portrait and landscape orientations on mobile devices, adapting the conversation display and input methods accordingly.

**4.2.2 Conversation Flow**

The conversation flow defines how interactions progress and how context is maintained throughout a user session.

**Natural Dialogue Management**

SNEA will strive to create conversations that feel natural and human-like while still operating within the constraints of a rule-based system.

**Natural dialogue management includes:**

Coherent conversation progression that builds logically from one exchange to the next without awkward transitions or repetitive phrasing. The system will acknowledge user inputs appropriately before providing new information, creating a sense of listening and understanding similar to human conversation.

Language patterns will avoid overly robotic or formulaic phrasing while maintaining a consistent brand voice that balances professionalism with approachability. The conversation will include appropriate confirmation and clarification requests when needed, but will avoid redundant verification when the intent is clear.

SNEA will demonstrate personality consistency throughout interactions with a defined character that remains stable across conversation topics and functions. This includes consistent formality level, terminology usage, and response styles.

**Context Retention**

Context awareness is essential for multi-turn conversations that feel cohesive rather than disconnected.

**Context retention capabilities include:**

Session memory that remembers referenced accounts, products, or topics within the current conversation, allowing users to ask follow-up questions without repeating identifiers. For example, after asking about savings accounts, a user could simply ask "What's the interest rate?" without needing to specify the account type again.

The system will maintain topic context across multiple question-answer pairs, recognizing when new questions relate to the previously established subject. This includes support for anaphora resolution, handling pronouns like "it" or "them" by connecting them to previously mentioned entities.

Context decay will be implemented thoughtfully, gradually reducing the influence of older conversation topics as new ones are introduced. This prevents context confusion while still allowing natural conversation flow. Users will have the option to explicitly change topics or clear context when desired.

**Fallback Strategies**

Even with well-designed conversation flows, users may input queries that the system doesn't understand or can't handle appropriately. Effective fallback strategies maintain a positive user experience in these scenarios.

**Fallback strategies include:**

Graceful handling of unrecognized inputs that acknowledges the limitation without breaking the conversational experience. Instead of generic "I don't understand" responses, SNEA will offer targeted suggestions based on partial understanding or conversation history.

When the intent is unclear but similar to known patterns, the system will offer suggestions that might match the user's goal, providing quick-access buttons to common intents. For example, "Did you want to know about our savings account interest rates or checking account fees?"

After multiple consecutive fallbacks, the system will implement escalation options such as suggesting more structured queries or offering alternative contact methods for complex issues. Throughout the fallback process, SNEA will maintain a helpful, non-frustrating tone that acknowledges limitations without creating user frustration.

**Conversation Control**

Users should feel in control of the conversation direction and flow, with clear options to navigate, restart, or refocus the interaction.

**Conversation control features include:**

Clear options to restart the conversation entirely when the user wants to begin fresh. This will reset all context and state information, effectively beginning a new session.

Users will have the ability to clear specific context while maintaining the overall conversation, allowing them to switch topics cleanly without starting over completely. For multi-step processes like applications or calculations, cancel options will be available at each stage.

A help command will be accessible throughout the conversation, providing contextual assistance based on the current conversation state. This creates a safety net for users who become confused or need guidance on available options.