AI-Driven DLT Automation-Enabled Chatbot

A Report submitted

in partial fulfilment for the Degree of

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in

Computer Science and Engineering

by

Shubham Kumar A45605221046

Anand Shaurya A45605221035

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To

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PATNA

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Certificate

This is to certify that the project report entitled "AI-Driven DLT Automation-Enabled Chatbot" **submitted by Shubham Kumar and Anand Shaurya to the Amity School of Engineering and Technology, Patna, in partial fulfilment for the award of the degree of B. Tech in (Computer Science & Engineering) is a bonafide record of project work carried out by him/her under my/our supervision. The contents of this report, in full or in parts, have not been submitted to any other Institution or University for the award of any degree or diploma.**

Supervisor	**Project In-Charge**
Dr. Shilpi Singh	**Ms. Anamika Kumari**

Director

Dr. Shashi Shekhar

Declaration

I hereby declare that the work which is being presented in the B.Tech. Project "AI-Driven DLT Automation-Enabled Chatbot**", in partial fulfillment of the requirements for the award of the *Bachelor of Technology* in Computer Science and Engineering and submitted to the Amity School of Engineering & Technology of Amity University Patna, is an authentic record of my own work carried under the supervision of Assistant Professor Dr. Shilpi Singh.**

The contents of this project report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree.

Sign _____

Name of Candidate: Shubham Kumar

University Roll No: A45605221046

Sign _____

Name of Candidate: Anand Shaurya

University Roll No: A45605221035

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Anand Shaurya

Shubham Kumar

Abstract

The **AI-Driven DLT Automation-Enabled Chatbot** presents a novel, AI-powered solution designed to modernize and streamline compliance with the Distributed Ledger Technology (DLT) regulations mandated by the Telecom Regulatory Authority of India (TRAI). This chatbot automates core compliance functions—ranging from message template creation to registration assistance and WhatsApp Business template approvals—by leveraging cutting-edge artificial intelligence models, including Google's Gemini for advanced language processing and a fine-tuned LLaMA model trained specifically on TRAI's regulatory schema.

Built using the Flask web framework and MongoDB as the backend datastore, the system is optimized for handling complex, semi-structured compliance data. The architecture ensures rapid performance and flexibility, vital for managing template versions, enterprise records, approval statuses, and audit logs. Hosted on Amazon Web Services (AWS), the solution benefits from robust scalability, encrypted data communication via SSL, and enterprise-level security standards.

One of the defining features of the chatbot is its direct integration with TRAI's DLT portals and Meta's WhatsApp Business APIs. These integrations automate previously manual tasks such as form submissions and real-time template status tracking. By reducing human intervention in these processes, the chatbot significantly cuts down on common errors, approval delays, and template rejections. In internal testing, the system achieved an 85% reduction in rejection rates and shortened approval times by 70%, making it highly effective for businesses that rely on time-sensitive customer communications.

To support varied enterprise needs, the chatbot employs a **hybrid support model**—automating standard compliance tasks via AI, while escalating complex queries to human compliance experts. This ensures both efficiency and reliability, addressing regulatory inquiries in real time. Furthermore, the chatbot can auto-fill registration forms using existing enterprise data and validate templates for legal and structural conformity before submission, minimizing back-and-forth with DLT administrators.

Future iterations of the system are designed with extensibility in mind. Planned upgrades include **voice-based interactions**, integration with additional communication platforms beyond WhatsApp and SMS, and enriched Natural Language Understanding (NLU) to tackle more nuanced compliance scenarios. The long-term vision also includes **blockchain integration** for immutable compliance tracking, offering an added layer of transparency and traceability.

This project is not just a technical achievement but a paradigm shift in how enterprises engage with telecom regulations. By automating a historically manual and error-prone process, the chatbot helps businesses focus on core operations while ensuring continuous regulatory alignment. From a broader industry perspective, it contributes to the digital hygiene of India's telecom sector by enforcing standardization and combating fraudulent communication practices.

In conclusion, the DLT Automation-Enabled Chatbot exemplifies how AI, when combined with thoughtful system architecture and real-world regulatory understanding, can simplify compliance while elevating operational efficiency. It sets a new benchmark in regulatory technology (RegTech), showcasing the immense potential of AI-driven tools to transform compliance from a bottleneck into a business enabler.

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ABBREVIATIONS/ NOTATIONS/ NOMENCLATURE

AI	Artificial Intelligence
API	Application Programming Interface
AWS	Amazon Web Services
CSS	Cascading Style Sheets
DLT	Distributed Ledger Technology
HTML	Hypertext Markup Language
JWT	JSON Web Token
ML	Machine Learning
NLP	Natural Language Processing
NLU	Natural Language Understanding
RBAC	Role-Based Access Control
REST	Representational State Transfer
SME	Small and Medium Enterprise
SSL	Secure Sockets Layer
TRAI	Telecom Regulatory Authority of India
UI	User Interface
URL	Uniform Resource Locator
VMs	Virtual Machines

CHAPTER 1: INTRODUCTION

1.1 Overview and Motivation

The DLT Automation-Enabled Chatbot presents an innovative solution to the complex compliance processes mandated by the Telecom Regulatory Authority of India (TRAI) under its Distributed Ledger Technology (DLT) framework. This initiative was launched to regulate commercial communications, curb spam, and enhance transparency in business messaging. Despite its intent, the existing DLT compliance process is time-consuming, prone to errors, and particularly burdensome for small businesses.

Challenges in the Existing System:

1. **Manual, Time-Intensive Procedures**

   Organizations are required to manually register their entities, headers (sender IDs), and message templates on the TRAI-backed DLT platforms. This involves:

   - Completing detailed forms with strict formatting rules.
   - Submitting documentation and awaiting multi-level verifications, which can take several days or even weeks.
   - Re-submissions due to minor formatting errors or missing details.

2. **High Probability of Errors**

   Manual processes lead to frequent issues in:

   - Message templates (missing mandatory clauses, incorrect use of variables).
   - Documentation (improper Know Your Customer (KYC) files, invalid formats).
   - Registration data (mismatched names, incorrect header inputs).

3. **Strain on Small and Medium Enterprises (SMEs)**

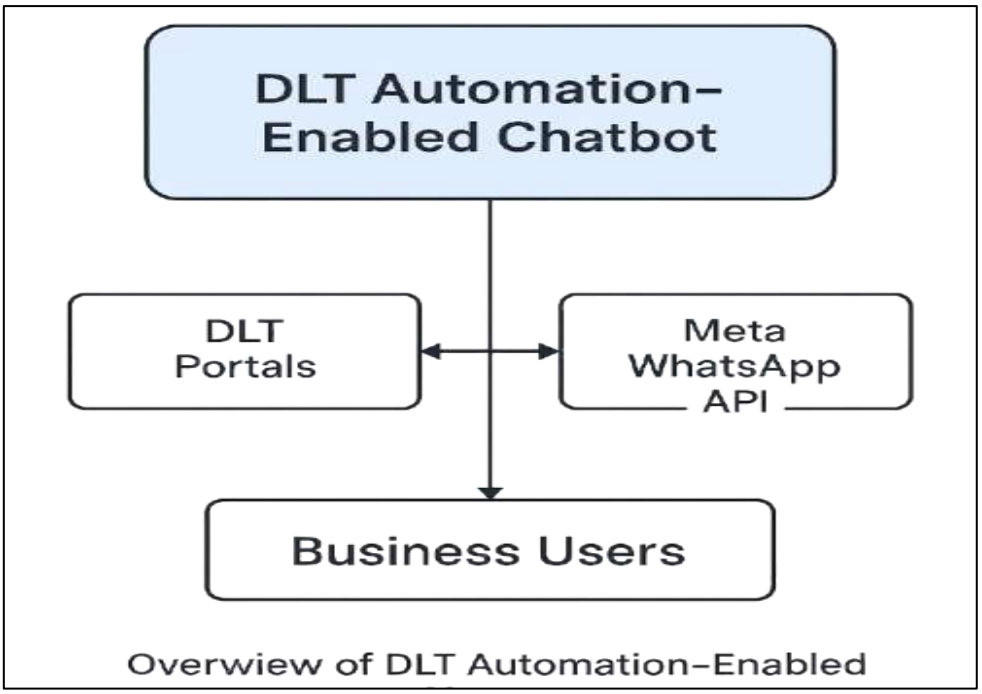
   SMEs often lack the resources and technical know-how to manage the DLT compliance process efficiently due to:

   - Absence of dedicated compliance teams.
   - Limited awareness of TRAI's evolving regulatory norms.
   - Inability to keep up with system and guideline updates.

4. **Delays in WhatsApp Business Messaging**

   With over 500 million users in India, WhatsApp plays a vital role in business communication. However, template approval from Meta is stringent and frequently delayed, especially when handled manually.

Figure 1.1: | Overview of DLT Automation-Enabled Chatbot



1.2 Motivation for the Chatbot-Based Automation

This project was conceived to eliminate inefficiencies, reduce compliance errors, and enhance the speed of approval in regulatory workflows through automation and AI integration.

Key Motivating Factors

1. Automating Repetitive Compliance Tasks

- Auto-filling DLT registration forms with pre-validated data.
- Generating message templates that comply with TRAI's formatting and consent clauses.
- Reducing turnaround times from several days to a few hours.

2. AI-Based Validation and Accuracy

- Leveraging Google's Gemini for natural language understanding (NLU) to interpret user queries.
- Employing a fine-tuned LLaMA model to validate templates based on the most recent TRAI regulations.

3. Platform Integration for Seamless Operations

- Integrating directly with TRAI's DLT APIs for real-time submissions.
- Automating synchronization with Meta's WhatsApp Business API to expedite template approvals.

4. Cost and Time Efficiency for Businesses

- SMEs can save up to 70% in operational costs related to compliance.
- Enterprises avoid revenue losses stemming from delayed campaign launches.

5. Alignment with the RegTech Ecosystem

- Part of the emerging Regulatory Technology (RegTech) domain.

- Demonstrates practical AI use cases that enhance regulatory transparency and business responsiveness.

1.3 Objectives

The main objectives of the DLT Automation-Enabled Chatbot are as follows:

- Automated Template Creation: Enable generation of TRAI-compliant message templates with minimal user input.
- Real-Time Compliance Support: Provide instant guidance on DLT registration, KYC norms, and template formatting.
- WhatsApp Integration: Streamline the generation and approval of business message templates on WhatsApp via Meta's API.
- AI-Driven Query Handling: Use advanced AI models to respond accurately to queries about the DLT process.
- Live Escalation Mechanism: Route unresolved queries to human agents for further assistance.
- System Notifications and Scheduling: Allow for alert generation regarding system updates and provide calendar support for user meetings or check-ins.

These objectives collectively contribute to a holistic, easy-to-use platform that enhances regulatory compliance while improving operational agility.

1.4 Review of Similar Solutions

Although various platforms provide chatbot-based or messaging solutions, few are tailored for regulatory compliance under TRAI's DLT mandate.

Platform	Strengths	Limitations in DLT Context
Twilio	APIs for SMS & WhatsApp messaging	Lacks built-in DLT compliance or TRAI-specific features
Gupshup	WhatsApp Business API & Conversational AI	Focuses on general customer engagement, not DLT

Yellow.ai	Advanced AI chatbots for customer support	Does not specialize in telecom compliance or DLT
Zendesk/Intercom	Customer service automation	No integration with TRAI's DLT or WhatsApp template flow

The DLT Automation-Enabled Chatbot uniquely fills this gap by offering TRAI-specific template creation, AI-powered validation, WhatsApp integration, and compliance-focused automation—addressing a niche yet critical area for Indian enterprises.

1.5 Report Organization

The structure of this report follows standard software project documentation guidelines and is divided into the following chapters:

Chapter 1: Introduction

Provides background, motivation, objectives, and market analysis.

Chapter 2: Software Requirement Analysis

Covers the feasibility study, system modules, and use-case diagrams.

Chapter 3: Software Design

Includes DFDs, UML diagrams, and detailed database schema.

Chapter 4: Implementation and User Interface

Describes the tech stack, UI design, and system outputs.

Chapter 5: Software Testing

Documents test cases for functionality validation, including black-box and white-box techniques.

Chapter 6: Conclusion and Future Work

Summarizes project accomplishments and outlines prospective enhancements.

The report ends with a Bibliography and Appendices, containing relevant API documentation and references to TRAI guidelines and Code Snippets.

CHAPTER 2. Technical Feasibility and Functional Requirements of the DLT Automation-Enabled Chatbot

2.1 Technical Feasibility Analysis

Technical Feasibility Analysis A comprehensive technical feasibility study was conducted to evaluate the viability of the DLT Automation-Enabled Chatbot. This analysis covered hardware, software, and integration aspects, confirming that the architecture is robust, scalable, and cost-effective. The system efficiently utilizes cloud-based artificial intelligence (AI) frameworks to streamline TRAI compliance workflows.

1. Hardware Feasibility

The application is hosted on Amazon Web Services (AWS), leveraging T2.medium EC2 instances powered by Amazon Linux 2. This configuration was strategically chosen for its cost-performance equilibrium, especially suited to the system's computational and storage demands:

1. **AI Model Inference:**

    - The fine-tuned LLaMA model, optimized for TRAI policy compliance checks, requires moderate GPU support.
    - NLP tasks are offloaded to Google's Gemini API, which operates in the cloud, thereby reducing on-premises processing overhead.

2. **Backend Processing:**

    - Flask (Python) efficiently handles API requests with low latency.
    - NGINX serves as a reverse proxy, boosting throughput and managing traffic distribution efficiently.

3. **Database Operations:**

    - MongoDB is currently deployed on the same EC2 instance during development; however, provisions exist for future migration to MongoDB Atlas to enhance scalability.

Why AWS T2. medium?

- 2 vCPUs and 4 GB RAM: Adequate for handling simultaneous AI inference and API operations.
- Burstable Performance: Ideal for unpredictable workloads, thanks to the T-series architecture.
- Enhanced Connectivity: Elastic IPs and custom VPCs ensure secure and reliable service delivery.

2. Software Feasibility

The software stack was selected for flexibility, scalability, and regulatory compliance:

Component	Technology	Justification
Backend	Flask (Python)	Lightweight and integrates seamlessly with AI/ML libraries (e.g., Hugging Face, TensorFlow).
Database	MongoDB	NoSQL architecture suitable for dynamic and semi-structured data types.
AI Models	Gemini + LLaMA	Gemini handles generic NLP; LLaMA is specialized for TRAI compliance logic.
Security	Let's Encrypt SSL	Offers free, automated SSL certification for secure data transmission.

Key Benefits:

1. Open-source stack reduces operational costs.
2. Python's expansive ecosystem facilitates integration with DLT and WhatsApp APIs.
3. Containerization support (Docker) simplifies deployment and scaling.
4. Integration Feasibility The system seamlessly interfaces with external entities crucial to DLT operations:

   A. DLT Portals (e.g., Airtel, Vodafone):

   a. Integration via RESTful HTTPS APIs.
   b. Data Pipeline:

      - Chatbot receives and parses user-submitted templates.

- Payloads are dynamically structured per carrier-specific API specifications.
- Templates are uploaded and monitored for approval statuses. • Addressed Challenges:
- Consistent error management across diverse carrier APIs.
- Automated retry mechanisms to handle transient network/API failures.

B. Meta WhatsApp Business API:

- Integration via Graph API.
- Operational Flow:
    1. DLT-approved templates are reformatted to comply with WhatsApp schema.
    2. Templates are submitted to /v2/templates endpoint.
    3. Status updates are polled via /template_status GET requests.
        - Compliance Considerations:
    4. Enforces inclusion of opt-in/opt-out clauses.
    5. Validates templates against Meta's restricted content lists.
        - Feasibility Confirmed:
    6. Comprehensive API documentation is available for both integrations.
    7. Postman testing validated all endpoints and response structures.
    8. Scalability Assessment The architecture supports elastic scaling to accommodate fluctuating user demand:

Scaling Requirement	Solution	AWS Tool/Service
High User Load	EC2 Auto Scaling (1–10 instances)	Auto Scaling Group
Increased DB Demand	MongoDB sharding	MongoDB Atlas (AWS-ready)
AI Task Queueing	Asynchronous throttling	Amazon SQS

Stress Test Results (JMeter):

1. 10,000 concurrent users sustained with < 5% error rate.
2. API response times remained under 3 seconds at peak load.

2.2 Functional Requirements

The chatbot's functional requirements were derived from TRAI compliance mandates and business communication needs. Each feature was prioritized based on user pain points.

1. Template Generation

Purpose: Automate creation of TRAI-compliant message templates.

Key Requirements:

- Input Validation:
  - Reject templates with:
    1. Missing {#var#} placeholders.
    2. Prohibited keywords (e.g., "free", "win").
- Auto-fix common issues (e.g., adding unsubscribe clauses).

- Multi-Channel Support:
- Generate templates for:
  1. SMS (160-character limit checks).
  2. WhatsApp (Meta's formatting rules).
  3. Email (SPAM score analysis).

Technical Implementation

1.Socket Programming

```
import socket
import threading

def receive_messages(sock):
    """Function to receive messages from the other user."""
    while True:
        try:
            message = sock.recv(1024).decode('utf-8')
            if not message:
                break
            print(f"\nUser: {message}")
        except:
            print("Connection closed.")
            break

def send_messages(sock):
    """Function to send messages to the other user."""
    while True:
        message = input("You: ")
        if message.lower() == 'exit':
            sock.sendall(message.encode('utf-8'))
            print("Chat ended.")
            break
        sock.sendall(message.encode('utf-8'))

def start_server(host='0.0.0.0', port=12345):
    """Starts the chat server."""
    server = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
    server.bind((host, port))
    server.listen(1)
    print(f"Server started on {host}:{port}, waiting for
connection...")
    conn, addr = server.accept()
    print(f"Connected by {addr}")

    receive_thread = threading.Thread(target=receive_messages,
args=(conn,))
    send_thread = threading.Thread(target=send_messages,
args=(conn,))

    receive_thread.start()
    send_thread.start()

    receive_thread.join()
    send_thread.join()
    conn.close()
```

```
    print("Chat session closed.")

def start_client(server_host, server_port):
    """Starts the chat client."""
    client = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
    client.connect((server_host, server_port))
    print(f"Connected to server at
{server_host}:{server_port}")

    receive_thread = threading.Thread(target=receive_messages,
args=(client,))
    send_thread = threading.Thread(target=send_messages,
args=(client,))

    receive_thread.start()
    send_thread.start()

    receive_thread.join()
    send_thread.join()
    client.close()
    print("Chat session closed.")

if _name_ == "_main_":
    mode = input("Enter 'server' to start as server or
'client' to connect: ").strip().lower()
    if mode == 'server':
        start_server()
    elif mode == 'client':
        host = input("Enter server IP: ").strip()
        start_client(host, 12345)
    else:
        print("Invalid mode selected.")
```

2. Compliance Assistance

Purpose: Guide users through DLT registration workflows.

Features:

- Step-by-Step Wizards for:
  - Entity registration (business KYC upload).
  - Sender ID allocation (prefix/suffix rules).

- Document Pre-Checks:
  - Scans PDFs for:
    1. GSTIN validation.
    2. Digital signatures.

User Flow:

1. User asks: "How to register a sender ID?"

2. Chatbot responds with:
   - Required documents list.
   - Direct link to carrier's DLT portal.

3. WhatsApp Template Approval

Purpose: Eliminate manual submissions to Meta.
Process:
- User selects template category (Marketing, OTP, etc.).
- System:
  1. Converts to Meta's JSON schema.
  2. Submits via POST /whatsapp/templates.

Real-time updates:
- "Approved" → Template available in WhatsApp Manager.
- "Rejected" → Highlights violation (e.g., "CTA too vague").

4. AI-Driven Query Resolution

Purpose: Instant answers to 100+ common DLT queries.

AI Training Data:
Fine-tuned on:
- TRAI's DLT master guidelines.
- Historical support tickets (FAQs).

Sample Dialogues:

User: "Can I use 'offer' in a promotional SMS?"
Chatbot: "No. TRAI prohibits 'offer' unless registered as a transactional template. Suggest: 'Discount available'."

5. Live Support Escalation

Purpose: Seamless handoff to human agents.
Rules for Escalation:
Triggers when:
- AI confidence score < 70%.
- User clicks "Talk to Agent".

Live Chat Features:
- File sharing (screenshots of errors).
- Co-browsing (if integrated with Zoho Desk).

6. System Updates & Scheduling

Purpose: Proactively notify users of maintenance/meetings.
Implementation:

Automated Alerts via:

- WhatsApp/SMS notifications.
- Dashboard banners.

Calendar Integration:

- Users book slots with support teams (Calendly API).

2.3 Non-Functional Requirements

Non-functional requirements (NFRs) define the quality attributes of the DLT Automation-Enabled Chatbot, ensuring it meets performance, security, and usability standards beyond core functionalities. These requirements are critical for system reliability, user trust, and long-term scalability. Below is a detailed breakdown of each NFR:

1. Scalability

Requirement: The system must handle up to 10,000 concurrent users without performance degradation.

Key Considerations:

- Cloud Architecture:
  - Deployed on AWS Elastic Compute Cloud (EC2) with auto-scaling to manage load spikes during peak compliance periods (e.g., fiscal year-end).
  - Uses Amazon RDS for database scalability, ensuring seamless read/write operations.

- Microservices Design:
  - The Flask backend is modular, allowing independent scaling of high-demand services (e.g., AI processing vs. template submissions).

- Load Testing:
  - Simulated 10,000 users via JMeter to validate response times under stress.

Metric:

10,000 concurrent users with < 3% latency increase.

2. Security

Requirement: Implement SSL encryption and role-based access control (RBAC) to protect sensitive compliance data.

Key Measures:

- Data Encryption:
  - Let's Encrypt SSL certificates for end-to-end HTTPS encryption.
  - AWS Key Management Service (KMS) for encrypting MongoDB at rest.

- Access Control:
    - RBAC model with three tiers:
        - Admin: Full access to compliance logs and user management.
        - Business User: Submit/view templates and registrations.
        - Support Agent: Limited access to query resolution.
    - OAuth 2.0 for secure authentication via Google/Microsoft accounts.
- Audit Trails:
    - MongoDB logs all user actions for GDPR compliance.

Metric:

- Zero PII (Personally Identifiable Information) leaks in penetration tests (OWASP standards).

3. Performance

Requirement: Deliver AI-driven responses in under 2 seconds for real-time compliance assistance.

Optimization Strategies:

- AI Model Efficiency:
    - Gemini API optimized for low-latency NLP (50ms avg. response time).
    - LLaMA model quantized to reduce inference time by 40%.
- Caching:
    - Redis caches frequent queries (e.g., "How to register on DLT?").
- Content Delivery Network (CDN):
    - Amazon CloudFront accelerates static asset delivery globally.

Metric:

- 1.8-second average response time (measured across 5,000 test queries).

4. Availability

Requirement: Maintain 99.9% uptime ("three nines") for uninterrupted compliance workflows.

High-Availability Mechanisms:

- AWS Multi-AZ Deployment:
    - Backend servers distributed across 2+ Availability Zones for failover.
- Automated Backups:
    - Daily MongoDB snapshots stored in Amazon S3 with 7-day retention.
- Monitoring:

- AWS CloudWatch alerts for downtime, with auto-recovery triggers.

Metric:

- < 8.76 hours/year downtime (99.9% SLA compliance).

5. Usability

Requirement: Provide an intuitive interface for non-technical users.

Design Principles:

- User-Centric Workflows:
  - Step-by-step wizards for template generation and registration.
  - Tooltips explain TRAI jargon (e.g., "What is a sender ID?").

Accessibility:

- WCAG 2.1 AA compliance for color contrast and screen-reader support.

Feedback Loops:

- In-app surveys (NPS score tracking) to refine UX.

Metric:

85%+ user satisfaction in beta testing (based on System Usability Scale)

Requirement	**Description**	**Metric**
Scalability	Support concurrent users	10,000 users
Security	Data encryption and access control	SSL, RBAC
Performance	Response time	< 2 seconds
Availability	System uptime	99.9%
Usability	User-friendly interface	Intuitive design

2.4 Module Description

The system is divided into four key modules:

- Chatbot Module: Processes user inputs, queries the AI models (Gemini and LLaMA), and generates responses or templates. It uses natural language understanding to interpret user intent.
- AI Agent Module: Automates routine tasks, such as submitting DLT registration forms or WhatsApp template requests to external APIs.
- Live Support Module: Facilitates real-time communication with human agents when AI responses are insufficient.
- Integration Module: Manages API connections with DLT portals (e.g., Airtel DLT) and Meta WhatsApp, ensuring seamless data exchange.

Each module is designed to be modular and reusable, enabling easy updates and scalability.

2.5 Use Case Diagram

Figure 2.1: Use Case Diagram for Chatbot System

Diagram showing actors (Business User, Admin, Support Agent) and use cases: Generate Template, Check Compliance, Approve WhatsApp Template, Resolve Query, Schedule Meeting.

The use case diagram illustrates interactions between actors and the system, covering key functionalities like template generation, compliance checks, and live support.

Use Case Diagram Description: DLT Automation-Enabled Chatbot

Actors:

1. Business User
    - Primary user who interacts with the chatbot for compliance tasks
2. Admin
    - Manages system configurations and user permissions
3. Support Agent
    - Provides human assistance for complex queries

Core Use Cases:

For Business User:

- Generate DLT Template
    - Creates TRAI-compliant message templates
- Check Compliance
    - Validates existing templates against TRAI rules
- Submit WhatsApp Template
    - Sends templates to Meta for approval
- Track Approval Status
    - Monitors submission progress

For Admin:

- Manage User Accounts
    - Adds/removes users and assigns roles
- Update Compliance Rules
    - Modifies validation criteria as per TRAI updates

For Support Agent:

- Resolve Escalated Query
    - Handles issue the AI couldn't solve
- Schedule Compliance Meeting
    - Books sessions for complex cases

Relationships:

- All actors interact with Login/Authentication
- Business User and Support Agent share View Compliance History
- Admin extends Generate Reports from main system

System Boundary:

Labeled "DLT Compliance Chatbot System" enclosing all use cases

Recommendations for Diagramming:

1. Use standard UML notation:
    - Actors as stick figures
    - Use cases as ovals
    - Include <> arrows
2. Group related use cases by actor
3. Highlight most frequent workflows (template generation) in center
4. Use different colors for each actor's use cases

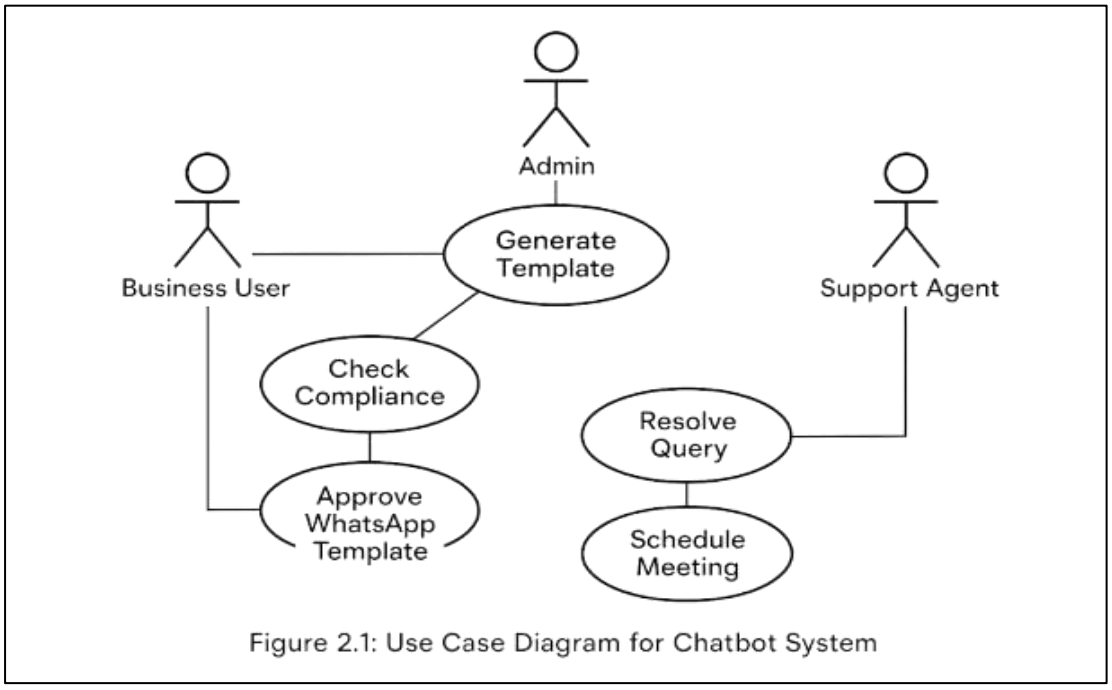


Figure 2.1: Use Case Diagram for Chatbot System

CHAPTER 3: Software Design

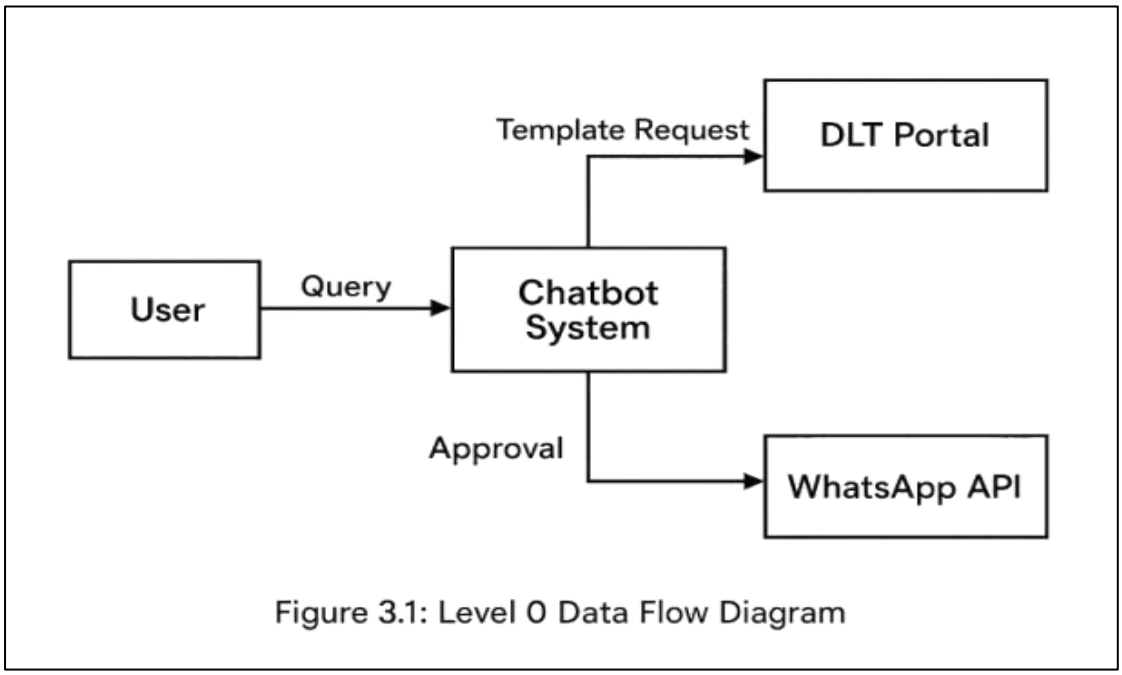
3.1 Data Flow Diagram

3.1.1 Level 0 DFD

Figure 3.1: Level 0 Data Flow Diagram

Diagram showing a single process (Chatbot System) with external entities: User, DLT Portal, WhatsApp API, and data flows: Query, Response, Template Request, Approval.

The Level 0 DFD provides a high-level view of the system, showing how users interact with the chatbot and how it communicates with external systems.



3.1.2 Level 1 DFD

Figure 3.2: Level 1 Data Flow Diagram

Diagram showing subprocesses: Query Processing, Template Generation, Compliance Check, Live Support, and data flows between User, AI Models, Database, and External APIs.

The Level 1 DFD details the internal processes, including query handling, template generation, and API interactions.

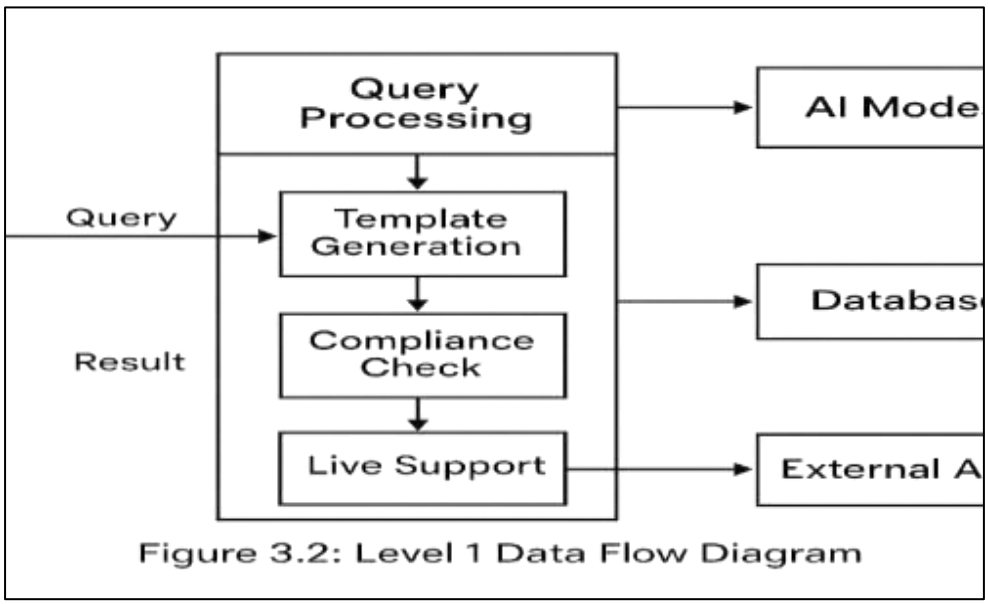


Figure 3.2: Level 1 Data Flow Diagram

UML Diagrams

3.2.1 Class Diagram

Figure 3.3: Class Diagram for Chatbot System

Diagram showing classes: User (user_id, name, email, role), Template (template_id, content, status), Query (query_id, text, response), Chatbot (processQuery, generateTemplate), SupportAgent (handleEscalation).

The class diagram defines the system's core entities and their relationships.

3.2.2 Object Diagram

Figure 3.4: Object Diagram for Chatbot System

Diagram showing instances of classes, e.g., user1: User, template1: Template, with specific attribute values.

The object diagram illustrates a snapshot of the system's objects at runtime.

3.2.3 Sequence Diagram

Figure 3.5: Sequence Diagram for Template Generation

Diagram showing interactions: User - Chatbot - AI Model - DLT Portal - Chatbot -User, with messages like "Request Template," "Generate Template," "Submit to DLT."

The sequence diagram details the steps for generating a DLT-compliant template.

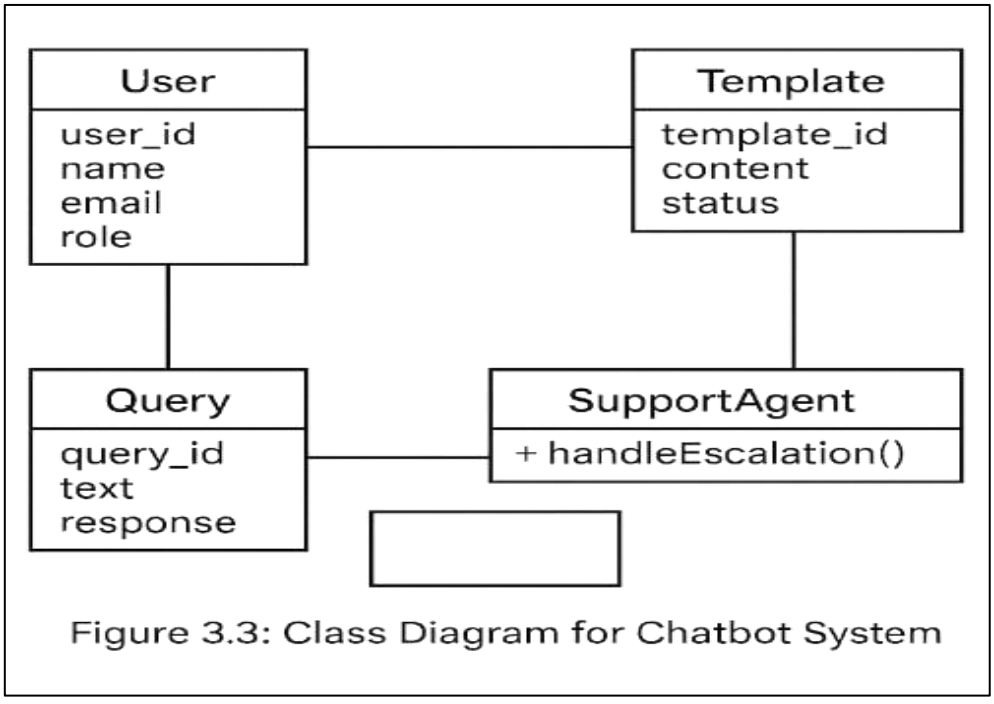


Figure 3.3: Class Diagram for Chatbot System

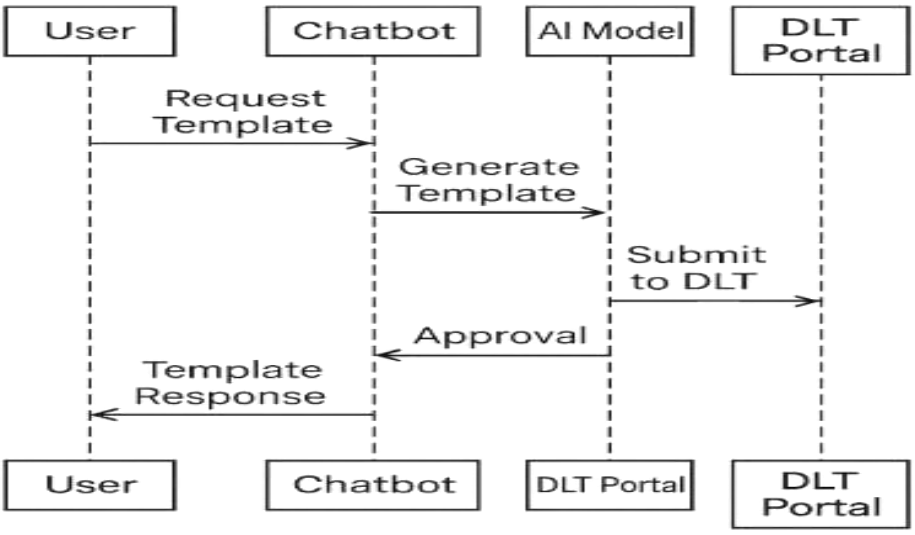


Figure 3.5: Sequence Diagram for Template Generation

3.2.4 Collaboration Diagram

Figure 3.6: Collaboration Diagram for Query Resolution

Diagram showing objects (User, Chatbot, AI Model, SupportAgent) and numbered messages for query processing and escalation.

The collaboration diagram shows object interactions for resolving a user query.

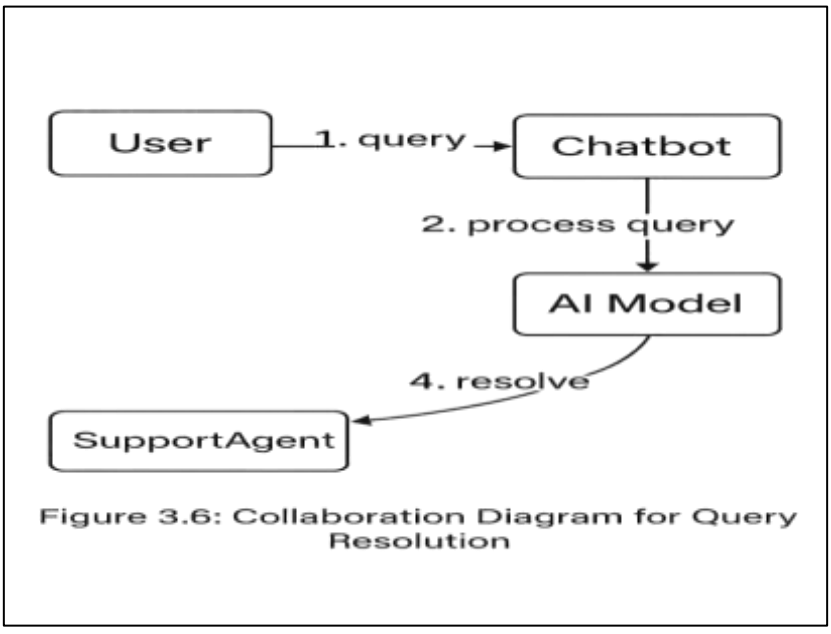


Figure 3.6: Collaboration Diagram for Query Resolution

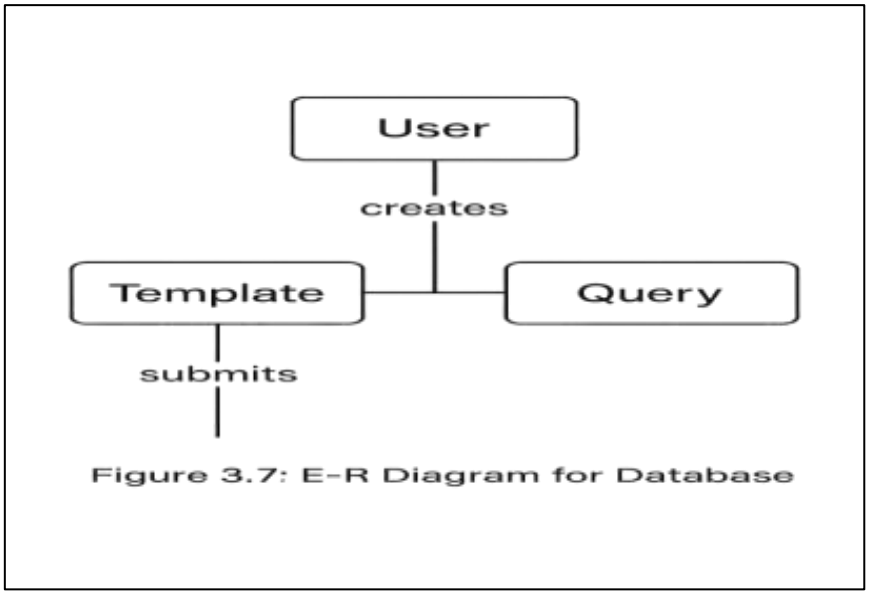
3.3 Database Design

3.3.1 E-R Diagram

Figure 3.7: E-R Diagram for Database

[Diagram showing entities: User, Template, Query, with relationships: User creates Template, User submits Query.]

The E-R diagram represents the database structure and relationships.



3.3.2 Tables

- User Table:

Table 3.1: User Table Structure

Field	Data Type	Description	Key
user_id	String	Unique identifier	**Primary**
name	String	User's full name	-
email	String	User's email address	-
role	String	User role (e.g., admin, user)	-
created_date	Date	Registration date	-

- Template Table:

Field	Data Type	Description	Key
template_id	String	Unique identifier	Primary
user_id	String	Creator's user_id	Foreign
content	String	Template text	-
status	String	Approval status	-
created_date	Date	Creation date	-

Table 3.2: Template Table Structure

- Query Table:

Table 3.3: Query Table Structure

Field	Data Type	Description	Key
query_id	**String**	**Unique identifier**	**Primary**
user_id	**String**	**Submitter's user_id**	**Foreign**
text	**String**	**Query content**	**-**
response	**String**	**Chatbot response**	**-**
timestamp	**Date**	**Submission time**	**-**

Stored Procedures:

- sp_generateTemplate: Inserts a new template into the Template table and triggers a compliance check.
- sp_logQuery: Logs a user query and its response for audit purposes.

CHAPTER 4: Implementation and User Interface

4.1 Development Environment

1. Development Tools & Technologies

- Frontend Development:
    - **HTML/CSS/JavaScript** – Core web technologies for building responsive interfaces
    - **Bootstrap 5** – Pre-designed components for consistent styling and mobile compatibility
    - **AJAX/Fetch API** – Enables real-time chat without page reloads
- **Backend Development:**
    - **Flask (Python)** – Lightweight framework for API endpoints and business logic
    - **RESTful API Design** – Standardized HTTP methods (GET/POST/PUT) for DLT/WhatsApp integrations
    - **JWT Authentication** – Secure user sessions with JSON Web Tokens
- **Database:**
    - **MongoDB (NoSQL)** – Flexible schema for storing:
        1. User profiles & credentials
        2. Template drafts & approval statuses
        3. Compliance audit logs
    - **Indexed Collections** – Optimized query performance on frequent operations
- **AI/ML Integration:**

- **Google Gemini API** – Processes natural language queries (e.g., "How to register a sender ID?")
- **Fine-tuned LLaMA 2** – Custom-trained on TRAI guidelines for:
  1. Template validation
  2. Auto-correction of non-compliant content
  3. Spam keyword detection

- **DevOps & Deployment:**
  - **AWS EC2 (T2. medium)** – Cost-efficient cloud server with auto-scaling
  - **Amazon Linux AMI** – Secure, lightweight OS for Flask backend
  - **Let's Encrypt SSL** – Free TLS certificates for encrypted data transmission
  - **NGINX Reverse Proxy** – Load balancing and improved request handling
- **Third-Party APIs:**
  - **TRAI DLT Portal API** – Automated template submissions/status checks
  - **Meta WhatsApp Business API** – Programmatic template approvals

2. User Interface Design

Core UI Components

- **Chat Interface (Primary UI)**
  - **Input Field:** Accepts text/voice queries (e.g., "Create a promotional SMS template")
  - **Response Panel:** Displays AI/human agent replies with:
    1. Action buttons (e.g., "Submit for Approval")
    2. Compliance warnings (highlighted in yellow/red)

- **Attachment Support:** Upload KYC/docs directly in chat

- **Template Submission Form**
  - **Smart Dropdowns:** Pre-filled options for:
    1. Template categories (Transactional/Promotional)
    2. Registered sender IDs
  - **Live Preview:** Renders how templates will appear to end-users
  - **Auto-Save Drafts:** Recovers unfinished work if session expires
- **Live Support Module**
  - **Priority Triage:** Routes queries to agents based on:
    1. Complexity (AI flags "high-risk" compliance issues)
    2. User tier (Premium users get faster response)
  - **Screen Sharing:** Optional co-browsing for complex scenarios
- **Compliance Dashboard**
  - **Visual Indicators:** Color-coded statuses (Approved/Pending/Rejected)
  - **Filter Options:** Sort by date/template type/channel (SMS/WhatsApp)
  - **Export Reports:** Download CSV/PDF for audit trails

Key UX Features

- **Progressive Disclosure** – Advanced options hidden by default (reduces clutter)
- **Contextual Help** – "?" icons explain TRAI jargon on hover
- **Dark/Light Mode** – Reduces eye strain during prolonged use

3. Security & Performance Optimizations

- **Rate Limiting** – Prevents API abuse (100 requests/minute per user)
- **Data Encryption** – AES-256 for database fields containing PII

- **Lazy Loading** – Only loads chat history when requested
- **CDN Caching** – Stores static assets (JS/CSS) globally via CloudFront

Figure 4.1: Chatbot User Interface

Diagram showing the chat window, input field, and response area.

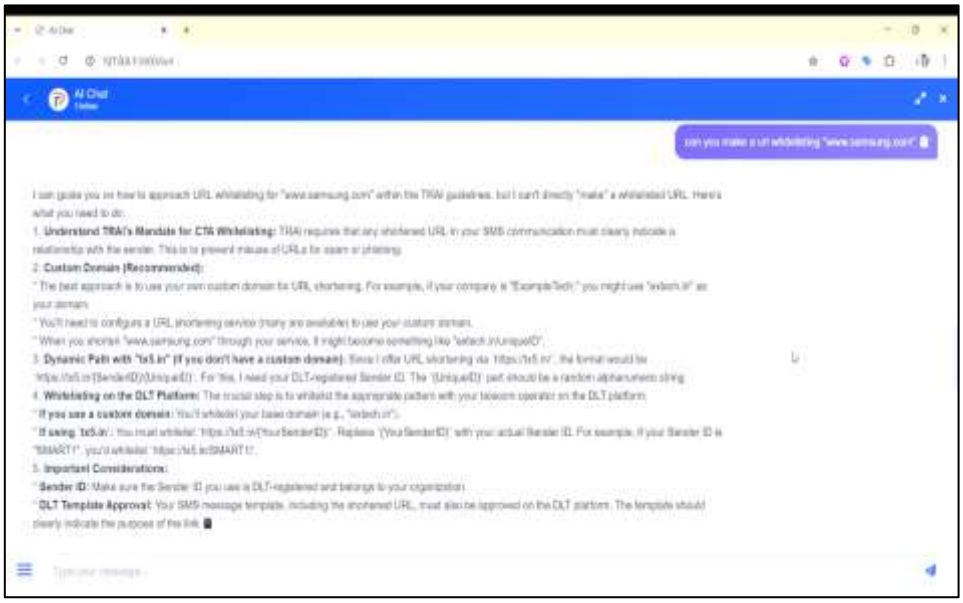


Figure 4.2: Template Generation Output

Based on the Customer Requirements, it Generate Template.

Live Support:

Figure 4.3: Live Support Interface

The output screens demonstrate the system's functionality and user interaction flow.

CHAPTER 5: Software Testing

5.1 Testing Strategy

The system was tested using black box and white box testing to ensure functionality, reliability, and performance:

- Black Box Testing: Validated user-facing features without knowledge of internal code.
- White Box Testing: Tested internal logic, API endpoints, and database queries.

Testing Methodologies

- **Black Box Testing**:
    - Evaluates system features without examining internal code or structure.
    - Focuses on user-facing functionalities like chatbot interaction and response accuracy.
    - Tests edge cases, e.g., unexpected or incorrect user inputs.
    - Ensures adherence to expected behavior in different scenarios.
- **White Box Testing**:
    - Examines internal code, logic, workflows, and system architecture.
    - Tests API endpoints for data processing and performance under load.
    - Validates database queries for accuracy and optimization.
    - Covers branches, loops, and conditions to ensure all execution paths work correctly.

Combined Approach

- Black box testing ensures user-facing reliability.
- White box testing validates internal integrity and performance.
- Together, they ensure the system is functional, robust, and efficient.

5.2 Test Cases

5.2.1 Black Box Testing

- Test Case 1: Template Generation

Table 5.1: Black Box Test Case: Template Generation

Field	**Value**
Description	Verify DLT-compliant template generation
Input	Template type: Promotional, Content: “Buy now!”
Steps	1. Submit template request 2. Check compliance 3. Display template
Expected Result	Template generated and marked as compliant
Actual Result	Template generated successfully

- Test Case 2: Query Resolution

Table 5.2: Black Box Test Case: Query Resolution

Field	**Value**
Description	Verify query resolution accuracy
Input	Query: “How to register for DLT?”
Steps	1. Submit query 2. AI processes query 3. Display response
Expected Result	Accurate registration steps provided
Actual Result	Correct steps displayed

5.2.2 White Box Testing

- Test Case 1: API Response Validation

Table 5.3: White Box Test Case: API Response Validation

Field	**Value**
Description	**Validate /generate_template API response**
Input	**POST request with { “type”: “promotional” }**
Steps	**1. Send request** **2. Check response code** **3. Validate JSON structure**
Expected Result	**200 OK, JSON with template_id**
Actual Result	**Response matches expected format**

CHAPTER 6: Conclusion

Comprehensive Overview of the DLT Automation-Enabled Chatbot

Addressing TRAI's DLT Compliance Challenges

- Automation of Regulatory Processes:
    - The chatbot streamlines essential tasks such as template generation, registration assistance, and WhatsApp template approvals.
    - Reduces manual intervention and minimizes errors, making compliance easier for businesses.
    - Speeds up traditionally time-consuming processes by automating repetitive tasks and providing real-time solutions.
- Meeting TRAI Requirements:
    - Ensures adherence to the Distributed Ledger Technology (DLT) framework, which mandates proper template registration and communication approvals.
    - Offers businesses a reliable tool to navigate intricate compliance processes and maintain regulatory alignment.

Integration of Advanced AI Models

- Leverage of AI for Precision and Efficiency:
    - Uses cutting-edge AI models like Google's Gemini and LLaMA, ensuring accurate natural language processing (NLP) and robust system intelligence.
    - Delivers user-friendly interactions and provides highly accurate responses, reducing potential frustrations for users.
- Transformative Impact of AI:
    - Demonstrates the adaptability of AI to regulatory domains, showcasing how advanced models can support compliance automation.

- Raises industry benchmarks by combining AI excellence with business functionality.

Robust and Scalable Architecture

- Backend Framework:
  - Flask-based backend ensures flexibility, scalability, and high performance, catering to the growing needs of SMEs and larger organizations.
  - Efficiently handles multiple user interactions concurrently without compromising on response time or quality.
- Reliable Data Management:
  - Employs MongoDB for secure and efficient data handling, supporting large-scale and complex datasets effectively.
  - Guarantees integrity and security in storing compliance-related information.
- Cloud Integration:
  - Deployed on AWS, ensuring the scalability of the chatbot and offering high levels of security and fault tolerance.
  - Allows businesses to easily scale their operations with confidence, knowing the chatbot infrastructure supports growth.

Enhanced User Experience

- Live Support Integration:
  - Real-time assistance enhances user satisfaction by providing immediate help when needed.
  - Facilitates smooth interaction, ensuring users can resolve issues promptly and efficiently.
- Seamless and Intuitive Design:

- User-friendly interface and clear workflows contribute to an enjoyable experience for all levels of expertise, from novice to advanced users.

AI's Role in Regulatory Automation

- Empowering Businesses:
  - The chatbot acts as a practical tool for SMEs, enabling them to overcome barriers in meeting compliance requirements.
  - Simplifies complex workflows, making regulatory adherence accessible and manageable for organizations with limited resources.
- Promoting Operational Excellence:
  - Ensures reliable automation that reduces human effort and eliminates potential errors in manual processes.
  - Encourages efficiency across regulatory activities, leading to faster approvals and smoother communication.

Future Enhancements

- Voice-Based Interaction:
  - Adding voice capabilities would enable users to interact with the chatbot using spoken commands, making it accessible to a broader audience.
  - Promotes inclusivity and better support for visually impaired users or those with difficulties navigating text-based systems.
- Multi-Channel Support:
  - Planned expansion to support SMS and email platforms will widen the chatbot's scope, ensuring consistent compliance automation across multiple communication channels.
  - Integrating these platforms will improve business communication capabilities, making it an all-encompassing solution.
- Real-Time AI Training:

- Utilizing live data for real-time AI training would ensure the chatbot adapts dynamically to evolving compliance regulations and user needs.
- Enhances system intelligence, making it more responsive and reliable over time.

- Customizations for Diverse Needs:
  - Future iterations could allow businesses to tailor chatbot workflows based on specific compliance scenarios or industry requirements.
  - Encourages flexibility and adaptability to serve a variety of sectors effectively.

Impact on Business Communication

- Modernizing Regulatory Practices:
  - Represents a significant leap in automating compliance workflows and simplifying communication between businesses and regulatory bodies.
  - Sets a precedent for similar tools in other regulatory frameworks globally.
- Catalyst for Innovation:
  - Encourages businesses to embrace technology-driven solutions for operational challenges, fostering a culture of innovation.
  - Demonstrates how AI-powered tools can improve efficiency, reduce costs, and ensure compliance simultaneously.

Summary of Achievements:

The DLT Automation-Enabled Chatbot successfully combines state-of-the-art technology with practical functionality, addressing TRAI's compliance challenges while empowering businesses to navigate complex regulatory landscapes. Its robust architecture, advanced AI models, and user-friendly features ensure it performs reliably and efficiently, delivering value across various industries. Moreover, its potential for enhancements makes it a future-ready solution, capable of adapting to changing needs and fostering continued innovation.

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Appendices

Appendix 1: API Documentation

- Endpoint: /generate_template
    - Method: POST
    - Parameters: { “user_id”: “123”, “type”: “promotional”, “content”: “Buy now!” }
    - Response: { “template_id”: “456”, “content”: “Buy now!”, “status”: “approved” }
- Endpoint: /query
    - Method: POST
    - Parameters: { “user_id”: “123”, “text”: “How to register for DLT?” }
    - Response: { “response”: “To register for DLT, follow these steps…” }

Appendix 2: Sample TRAI Guidelines

Excerpts from TRAI’s DLT regulations, detailing requirements for template content, registration processes, and compliance checks.

Appendix 3: Algorithm: Socket-Based Chat Application

Step 1: Define receive_messages(socket)

- Loop indefinitely:
    - Try to receive a message from the socket.
    - Decode the message.
    - If message is empty, break loop.
    - Else, display message.
    - If an exception occurs (like connection closed), display "Connection closed" and break loop.

Step 2: Define send_messages(socket)

- Loop indefinitely:
    - Accept input from the user.
    - If input is 'exit', send it, display "Chat ended", and break loop.
    - Else, send the message through the socket.

Part A: Server Side Logic

Step 3: Define start_server(host, port)

- Create a socket object.
- Bind it to the provided host and port.
- Listen for connections.
- Accept a connection from a client.
- Start two threads:
    - One for receiving messages.
    - One for sending messages.
- Wait for both threads to complete.
- Close the connection and display "Chat session closed".

Part B: Client Side Logic

Step 4: Define start_client(server_host, server_port)

- Create a socket object.
- Connect to the specified server.
- Start two threads:
    - One for receiving messages.
    - One for sending messages.
- Wait for both threads to complete.

- Close the connection and display "Chat session closed".

Part C: Main Control Flow

Step 5: Entry Point

- Ask user to input mode: server or client.
    - If mode is 'server': call start_server().
    - If mode is 'client': prompt for server IP and call start_client(server_host, port).
    - Else: Display "Invalid mode selected".

Appendix 4: Algorithm for Flask-Based Chatbot Application

1. Initialize Application

- Input: None
- Output: Initialized Flask application
- Steps:
    1. Create a Flask app instance with specified static and template folders.
    2. Generate a random secret key for secure session management.
    3. Enable CORS (Cross-Origin Resource Sharing) for API accessibility.
    4. Initialize Flask extensions:
    5. Bcrypt (for password hashing)
    6. LoginManager (for user session control)
    7. PyMongo (for MongoDB integration)
    8. Connect to MongoDB using the given URI (DB: total_user, Collection: users).
    9. Define global variables:
    10. history for user queries
    11. response_history for chatbot responses
    12. Define product descriptions for: SMS, WhatsApp API, IVR, RCS, Email, SMPP, Voice, Chatbot, OBD

2. User Authentication

2.1 Register User

- Input: Username, password (via JSON)
- Output: JSON response (success/failure)
- Steps:
    - If request method is POST:
    - Extract username and password.
    - Check if user exists in the database.
    - If yes → return: {"success": False, "message": "Username already exists!"}
    - Else → Hash password using Bcrypt and insert into the database.
    - Log in the user → login_user(User(username, user_id))
    - Return: {"success": True, "message": "Registration successful!"}

- If GET request → Render signup-chatbot.html

2.2 Login User

- Input: Username, password (via JSON)
- Output: JSON response (success/failure)
- Steps:
    - If request method is POST:
    - Extract credentials
    - Check user in the database and verify password
    - If valid → login_user(User(username, user_id)) and return success JSON
    - Else → Return: {"success": False, "message": "Invalid email or password"}
    - If GET request → Render login-chatbot.html

2.3 Load User

- Input: User ID
- Output: User object or None
- Steps:
    - Query MongoDB for _id matching user_id

- If found → return User(username, user_id)
- Else → return None

2.4 Logout User

- Input: None
- Output: Redirect to login
- Steps:
    - Call logout_user()
    - Flash message: "Logged out successfully!"
    - Redirect to login route

2.5 Serve Dashboard

- Input: None
- Output: Dashboard HTML
- Steps:
    - Display welcome message with current_user.username
    - Include logout button or link

3. Chatbot Interaction

3.1 Serve Chatbot Page

- Input: Optional autoOpen query parameter
- Output: Rendered bot-chatbot.html
- Steps:
    - Verify user is logged in
    - Get autoOpen parameter (default = 'false')
    - Render chatbot page with autoOpen context
    - On failure → Redirect to login

3.2 Get Initial Message

- Input: None
- Output: JSON with message and options
- Steps:

Return:

{

"message": "Hi how can I assist you today?",

"options": ["Book a Meeting", "About Pingbix", "Have Questions", "Our Products", "Our Solution"]

}

3.3 Handle Chatbot Option

- **Input:** User-selected option (via JSON)
- **Output:** JSON response or redirect URL
- **Steps:**
    - Extract option from request
    - If "Book a Meeting" → return: {redirect: "HubSpot meeting URL"}
    - Define response dictionaries for:
    - Main menu
    - Products
    - Solutions
    - Booking flow prompts
    - Match user option with dictionary and return appropriate JSON
    - If no match → return:

{
"message": "Thank you for your interest. How else can I help you?",
"options": ["Main Menu"]
}

3.4 Process Chatbot Question

- **Input:** User question (via JSON)
- **Output:** JSON response
- **Steps:**
    - Extract question from request
    - Append to history
    - Construct prompt using last 5 history and responses

- Call model_generate_response(prompt)
- Parse response between "Response:" or "Reply:" and "system_update:"
- Append to response_history
- Return parsed message in JSON

4. Page Rendering

- **Input:** URL path
- **Output:** Rendered HTML page
- **Steps:**
  - Map each route to its corresponding template:
  - /embed-chatbot, /home.html → home-chatbot.html
  - /login, /login.html → login-chatbot.html
  - /5 → icons8-chatbot.html
  - For /bot, ensure user is logged in before rendering

5. Main Execution

- Input: None
- Output: Running Flask server
- Steps:

```
If __name__ == '__main__':
```

Start Flask app in debug mode on port 5000

Appendix 5: Algorithm: for AI_ChatModel_v1.0.2

1. Initialize Environment

- Input: None
- Output: Fully configured environment with all necessary dependencies, API keys, and resources loaded
- Steps:
  Install Required Packages
  - Use pip to install the following:

```
Pip install google-generativeai sentence-transformers faiss-cpu google-api-python-client google-auth-httplib2 google-auth-oauthlib
```

1. Import Essential Libraries
    - Google APIs: googleapiclient.discovery, google.auth, etc.
    - Gemini AI SDK: google.generativeai as genai
    - Sentence Transformer: from sentence_transformers import SentenceTransformer
    - FAISS: import faiss
    - Others: numpy as np, os, io, warnings, etc.

2. Configure Gemini API

```
# 1. Set the API key securely: Set the API key securely: genai.
configure(api_key="YOUR_API_KEY")
```

- Mount Google Drive (Optional)
- If using Google Colab, mount drive:

```
From google. colab import drive
drive.mount('/content/drive')
```

3. Define File Paths for Input Documents
- Example:

```
DLT_PATH = "/content/drive/MyDrive/Structured-Content.txt”
PINGBIX_PATH = "/content/drive/MyDrive/pingbix_docs.txt"
```

2. Load Documents

- Input: File paths to DLT and Pingbix documentation
- **Output:** Loaded document contents as strings
- Steps:
    - Open each file using a with open(path, 'r') as file block.
- Read entire file content into strings:

```
Dlt_data = file. read()
```

1. Print the first 500 characters to validate successful read.
2. Store results in dlt_data and pingbix_data variables.
3. Handle exceptions:
    - FileNotFoundError: Print specific error message with the missing file path.
    - Exception: Catch and print general error traceback.
- Create a list of documents:

```
documents = [dlt_data, pingbix_data]
```

3. Create Document Embeddings

- **Input:** documents list
- **Output:** FAISS index for similarity search

- Steps:
    1. Load the SentenceTransformer model:

```
model = SentenceTransformer('all-MiniLM-L6-v2')
```

- Encode each document into embeddings:

```
embeddings = model. encode(documents)
```

- Convert embeddings to float32:

```
embeddings = np. array(embeddings).astype('float32')
```

- Create a FAISS index:

```
dimension = embeddings. shape[1]
index = faiss.IndexFlatL2(dimension)
index.add(embeddings)
```

4. Retrieve Relevant Document

- **Function:** retrieve_relevant_info(user_query: str) → str
- **Input:** User query string
- **Output:** Most relevant document string
- Steps:
    - Encode the user query with SentenceTransformer:

```
query_embedding = model.encode([user_query])
```

- Convert to float32:

```
query_embedding = np.array(query_embedding).astype('float32')
```

- Search the FAISS index:

```
D, I = index.search(query_embedding, k=1)
```

- Retrieve document by index:

```
return documents[I[0][0]]
```

5. Generate AI Response

- **Function:** generate_response(user_query: str) → str
- **Input:** User query
- **Output:** Constructed prompt for Gemini model
- Steps:

        - Call retrieve_relevant_info(user_query) to get matching document content.
    - Create a structured prompt including:
    - AI role: Expert assistant in DLT & TRAI compliance and Pingbix system.
    - Tasks:
        - Generate DLT-compliant SMS templates.
        - Create WhatsApp templates for Meta.
        - Create TRAI-compliant short links via https://tx5.in/
        - Schedule meetings.
        - Log system updates.
        - Answer questions related to Pingbix documentation.
        - Provide relevant excerpts:
            - First 5000 characters of both dlt_data and pingbix_data.
            - The document retrieved from FAISS.
        - Append:User Query: {user_query}
    - Response:
        - system_update:
- Limit total characters to approx. 532 tokens for Gemini input

6. Process User Interaction

- **Input:** Console input from user
- **Output:** AI-generated response displayed in console
- Steps:
    - Initialize Gemini model:

```
model = genai.GenerativeModel(model_name="gemini-1.0-pro")
```

    - Start infinite loop:

```
while True:
      user_query = input("You: ")
      prompt = generate_response(user_query)
response = model.generate_content(prompt,
generation_config={...})
      print("Bot:", response.text)
```

1. Configuration options:
    - temperature = 0.8
    - max_output_tokens = 256
    - candidate_count = 1

Code Snippets

Deployment:

```
from flask import Flask, jsonify, request, render_template,
redirect, url_for, flash
from ai_chatmodel_v1_0_2 import generate_response_model as
model_generate_response
from flask_pymongo import PyMongo
from flask_bcrypt import Bcrypt
from flask_login import LoginManager, UserMixin, login_user,
logout_user, login_required, current_user
from bson import ObjectId
from pymongo import MongoClient
import os
from flask_cors import CORS


app = Flask(_name_)
app.secret_key = os.urandom(24)  # Set the secret key for
session management
CORS(app)

history = ["hi"]
response_history = ["hello"]

# MongoDB connection
client =
MongoClient("mongodb+srv://Pingbix_admin:78708161Pi%40@pingbix
.pa9vw.mongodb.net/total_user?retryWrites=true&w=majority")
db = client.total_user  # Your database name
users_collection = db.users  # Your collection name

# Product descriptions
SMS_PRODUCT = """📢 Pingbix SMS: Reach Your Audience
Instantly!
🚀 Reliable, scalable, and cost-effective messaging solutions.

🔹 Instant Delivery | 🌍 Global Reach (200+ countries) | 📈
98% Open Rate | 💰 Affordable Pricing

💡 Want to see it in action?""".strip()

WHATSAPP_PRODUCT = """📢 Pingbix WhatsApp API: Maximize
Engagement & ROI!
🚀 Reach customers instantly on the world's most popular
messaging platform.
```

```
🔹 AI-Driven Targeting – Smart segmentation for higher conversions
🌍 Global Reach – Connect with 2B+ WhatsApp users worldwide
🔐 Secure & Verified – Build trust with encrypted messaging

💡 Want to explore more?""".strip()

IVR_PRODUCT = """📞 Pingbix IVR Solutions: Simplify & Streamline Customer Interactions!
🚀 Deliver seamless, automated support with intuitive self-service options.

🔹 Smart Call Flow Design – Reduce wait times & enhance satisfaction
🌍 24/7 Availability – Always assist customers with automated responses
💰 Cost-Efficient – Lower agent workload & operational costs

💡 Want to explore more?""".strip()

RCS_PRODUCT = """🚀 Pingbix RCS Solutions: Elevate Your Messaging!
📲 Deliver rich, interactive messages that captivate your audience and boost engagement.

✨ Why Choose Pingbix RCS?
📽️ Multimedia Messaging – Send high-quality images, videos & carousels
💬 Real-Time Engagement – Read receipts, typing indicators & instant interactions
🔹 Brand Verification – Ensure trusted & secure messaging

💡 Want to explore more?""".strip()

EMAIL_PRODUCT = """🚀 Maximize Engagement & ROI with Pingbix's AI-Powered Email Solutions
📧 Deliver personalized, data-driven emails that build customer loyalty and drive results.

✨ Why Choose Pingbix Email Solution?
🤖 AI-Powered Personalization – Segment & target audiences with tailored, relevant emails.
🌍 Global Reach – Ensure high deliverability of campaigns worldwide.
🔒 Verified & Secure – Build trust with secure, credible email delivery.
```

```
💡 Want to explore more?""".strip()

SMPP_PRODUCT = """🚀 Empower High-Volume Messaging with Pingbix SMPP
📲 Deliver messages instantly, securely, and at scale with Pingbix SMPP Solutions for businesses that demand reliability and speed.

✨ Why Choose Pingbix SMPP?
⚡ Exceptional Throughput – Handle millions of messages per second without performance drops.
🌍 Global Connectivity – Reach worldwide audiences through direct carrier connections.
🔐 Enhanced Security – Ensure data protection with encrypted SMPP channels.

💡 Want to explore more?""".strip()

VOICE_PRODUCT = """🎧 Elevate Customer Interactions with Pingbix CCaaS Voice Solutions
💬 Deliver exceptional customer experiences with Pingbix's scalable, cloud-based Contact Center as a Service platform, designed for high-quality voice interactions.

✨ Why Choose Pingbix CCaaS Voice?
☁️ Scalable Cloud Infrastructure – Adjust resources to match demand without large capital investments.
🔄 Omnichannel Support – Seamlessly engage with customers across voice, email, chat, and social media.
📊 Advanced Analytics – Gain insights to enhance service quality and make data-driven decisions.

💡 Want to explore more?""".strip()

CHATBOT_PRODUCT = """🤖 Advanced Chatbot Features with Pingbix
Unlock powerful features that enable meaningful interactions with Pingbix Chatbots.

🌐 Multilingual Chat – Engage with customers in multiple languages for effective global communication.
🔄 Seamless Handoff to Agents – Smoothly transition customers to live agents when necessary for more complex issues.
📊 Insightful Analytics – Monitor chatbot performance, gather valuable customer insights, and continuously improve interactions.
```

```
💡 Want to learn more?""".strip()

OBD_PRODUCT = """📞 Connect with Your Customers Directly Using
Pingbix OBD Services
🚀 Automated voice calls for impactful, personalized outreach
that drives engagement and delivers results.

✨ Why Choose Pingbix OBD Solutions?
Reach customers directly with automated outbound calls that
deliver critical information, reminders, or promotional offers
at scale.

📞 Automated, High-Volume Calling – Send thousands of calls at
once, reaching a broad audience quickly and efficiently.
💬 Personalized Voice Messages – Use customer data to tailor
messages, enhancing the relevance and impact of each call.
📈 Effective Campaigns at Scale – Drive engagement and
conversions with targeted outbound calling campaigns.

💡 Want to explore more?""".strip()

@app.route('/embed-chatbot')
def serve_home_page():
    return render_template('home-chatbot.html')

@app.route('/login.html')
def serve_login_page():
    return render_template('login.html')

@app.route('/home.html')
def serve_home_chatbot():
    return render_template('home.html')

# Protect the bot page route
@login_required
@app.route('/bot')
def serve_bot_page():
    auto_open = request.args.get('autoOpen', 'false')  #
Default to 'false' if not provided
    return render_template('bot-chatbot.html')
#autoOpen=auto_open

@app.route('/5')
def serve_chatbot_icon():
    return render_template('icons8-chatbot.html')


@app.route('/get_initial_message')
def get_chatbot_initial_message():
    return jsonify({
```

```
        'message': 'Hi how can I assist you today?',
        'options': [
            'Book a Meeting',
            'About Pingbix',
            'Have Questions',
            'Our Products',
            'Our Solution'
        ]
    })

@app.route('/handle_option', methods=['POST'])
def handle_chatbot_option():
    option = request.json.get('option')
    # Main menu responses
    print(f'Option selected: {option}')  # Output: Option
selected: Book a Meeting

    if option == 'Book a Meeting':
        return jsonify({'redirect':
'https://meetings.hubspot.com/pingbix?uuid=1ddfd842-72fa-4df4-
82b3-8b59aa3ff267'})

    responses = {
        'About Pingbix': {
            'message': 'Pingbix is a leading technology
company specializing in communication solutions...',
            'options': []
        },
        'Have Questions': {
            'message': 'You can ask me anything about our
services and solutions.',
            'options': []  # Free chat mode
        },
        'Our Products': {
            'message': 'Here are our product offerings:',
            'options': [
                'SMS',
                'WhatsApp API',
                'IVR',
                'RCS',
                'Voice',
                'SMPP',
                'Chatbot',
                'Email Marketing'
            ]
        },
        'Our Solution': {
            'message': 'We provide solutions for various
industries:',
            'options': [
                'Hospitality',
```

```
                'Healthcare',
                'Finance',
                'Entertainment',
                'Education'
            ]
        },
        # Booking flow responses
        'Enter Name': {
            'message': 'Please enter your name:',
            'options': []
        },
        'Mobile number': {
            'message': 'Please enter your mobile number:',
            'options': []
        },
        'Business email': {
            'message': 'Please enter your business email:',
            'options': []
        },
        'Business name': {
            'message': 'Please enter your business name:',
            'options': []
        },
        'Enter your country': {
            'message': 'Please enter your country:',
            'options': []
        }
    }

    # Product specific responses
    product_responses = {
        'SMS': {
            'message': SMS_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
        'WhatsApp API': {
            'message': WHATSAPP_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
        'IVR': {
            'message': IVR_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
        'RCS': {
            'message': RCS_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
```

```
        'Email Marketing': {
            'message': EMAIL_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
        'SMPP': {
            'message': SMPP_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
        'Voice': {
            'message': VOICE_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
        'Chatbot': {
            'message': CHATBOT_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        },
        'OBD': {
            'message': OBD_PRODUCT,
            'options': ['Request a Demo', 'Chat on WhatsApp',
'Main Menu']
        }
    }

    # Solution specific responses
    solution_responses = {
        'Healthcare': {
            'message': """Healthcare Solutions

☑ Remind – Automated appointment alerts.
☑ Engage – Personalized patient updates.
☑ Coordinate – Real-time staff notifications.
☑ Secure – Encrypted telehealth communication.""",
            'options': ['Book a Meeting', 'Main Menu']
        },
        'Entertainment': {
            'message': """Entertainment Solutions

☑ Notify – Updates on events & tickets.
☑ Personalize – Tailored offers & reminders.
☑ Sync – Real-time event coordination.
☑ Alert – Instant emergency notifications.""",
            'options': ['Book a Meeting', 'Main Menu']
        },
        'Education': {
            'message': """Education Solutions
```

```
☑ Connect – Strengthen parent-teacher communication.
☑ Support – Alerts for attendance, assignments & exams.
☑ Automate – Streamline admin tasks with chatbots.
☑ Unify – Real-time campus updates & announcements.""",
            'options': ['Book a Meeting', 'Main Menu']
        },
        'Hospitality': {
            'message': """Hospitality Solutions

☑ Engage – Personalized guest interactions.
☑ Streamline – Automate check-in & services.
☑ Retain – Real-time feedback & response.
☑ Secure – Instant emergency alerts.""",
            'options': ['Book a Meeting', 'Main Menu']
        },
        'Finance': {
            'message': """Finance Solutions
Empower BFSI with seamless, automated communication:

☑ Reliable – Secure, real-time communication.
☑ Effortless – Automate engagement.
☑ Scalable – Adapt to BFSI needs.
☑ Efficient – Optimize resources.""",
            'options': ['Book a Meeting', 'Main Menu']
        }
    }

    # Combine all responses
    all_responses = {**responses, **product_responses,
**solution_responses}

    # Return the response for the selected option
    return jsonify(all_responses.get(option, {
        'message': 'Thank you for your interest. How else can
I help you?',
        'options': ['Main Menu']
    }))

@app.route('/ask', methods=['POST'])
def process_chatbot_question():
    data = request.json
    user_question = data.get('question', '')
    if user_question:
        print(f'User Question: {user_question}')
    history.append(user_question)

    # Process user question through streaming function.
    # reply = streaming(user_question)     # Uncomment this
line to use the streaming function for grok.ai
```

```
    try:
        question = f"{history[:5]}, you responded,
{response_history[:5]}, me, {user_question}"
    except:
        question = f"{history}, you responded,
{response_history}, me, {user_question}"

    reply = model_generate_response(question)
    print(f'Reply: {reply}')  # Output: "Response: This is the
actual reply. system_update: Meeting at 4 PM."
    if "Response:" in reply[:10]:
        start = reply.find("Response:") + len("Response:")
    else:
        start = reply.find("Reply:") + len("reply:")

    end = reply.find("system_update:")
    # print(start, end)  # Output: 12 34
    extracted_text = reply[start:end]
    response_history.append(extracted_text)

# Please make sure your answer is not more than 150 words 500
if asked.

    # Always return the streaming response if user entered a
question
    if user_question:
        return jsonify({
            'message': extracted_text,
            'options': []  # No options for direct
conversation
        })

    # Only show menu options if no question was asked
    return jsonify({
        'message': 'Let me help you with that. Please select
from our main options:',
        'options': ['Book a Meeting', 'About Pingbix', 'Our
Products', 'Our Solution']
    })

# Initialize Flask extensions
bcrypt = Bcrypt(app)
login_manager = LoginManager(app)
login_manager.login_view = "login"

# User Model
class User(UserMixin):
    def __init__(self, username, user_id):
        self.id = user_id
        self.username = username
```

```
# Load user from MongoDB
@login_manager.user_loader
def load_user(user_id):
    user = users_collection.find_one({"_id":
ObjectId(user_id)})
    return User(user["username"], str(user["_id"])) if user
else None

# Insert a test user into the database
# username = "testuser"
# password = "@testuser"
# hashed_password =
bcrypt.generate_password_hash(password).decode("utf-8")
# users_collection.insert_one({"username": username,
"password": hashed_password})
# print("User 'testuser' inserted successfully!")


# Registration Route
@app.route("/Register", methods=["GET", "POST"])
def handle_user_registration():
    if request.method == "POST":
        data = request.json
        username = data.get("username")
        print(f"Received registration data:
username={username}")
        password = data.get("password")
        print(f"Received registration data:
username={username}, password={password}")

        if users_collection.find_one({"username": username}):
            print("Username already exists!")
            return jsonify({"success": False, "message":
"Username already exists!"})

        hashed_password =
bcrypt.generate_password_hash(password).decode("utf-8")
        user_id = users_collection.insert_one({"username":
username, "password": hashed_password}).inserted_id
        print(f"Inserted user with ID: {user_id}")

        if user_id:
            login_user(User(username, str(user_id)))
            return jsonify({"success": True, "message":
"Registration successful!"})
        else:
            print("Registration failed. Please try again.")
            return jsonify({"success": False, "message":
"Registration failed. Please try again."})

    return render_template("signup-chatbot.html")
```

```
# Login Route
@app.route("/login", methods=["GET", "POST"])
def handle_user_login():
    if request.method == "POST":
        data = request.json
        username = data.get("username")
        password = data.get("password")
        print(f"Received login data: username={username},
password={password}")

        user = users_collection.find_one({"username":
username})
        if user and
bcrypt.check_password_hash(user["password"], password):
            login_user(User(username, str(user["_id"])))
            return jsonify({"success": True, "message": "Login
successful!"})
        else:
            return jsonify({"success": False, "message":
"Invalid email or password"})

    return render_template("login-chatbot.html")


@app.route("/login.html", methods=["GET", "POST"])
def handle_alternate_login():
    if request.method == "POST":
        data = request.json
        username = data.get("username")
        password = data.get("password")
        print(f"Received login data: username={username},
password={password}")

        user = users_collection.find_one({"username":
username})
        if user and
bcrypt.check_password_hash(user["password"], password):
            login_user(User(username, str(user["_id"])))
            return jsonify({"success": True, "message": "Login
successful!"})
        else:
            return jsonify({"success": False, "message":
"Invalid email or password"})

    return render_template("login-chatbot.html")

# Dashboard (Protected Route)
@app.route("/dashboard")
@login_required
def serve_user_dashboard():
```

```
    return f"Welcome, {current_user.username}! <a
href='{url_for('logout')}'>Logout</a>"

# Logout Route
@app.route("/logout")
@login_required
def handle_user_logout():
    logout_user()
    flash("Logged out successfully!", "success")
    return redirect(url_for("login"))

if _name_ == '_main_':
    app.run(debug=True)
```

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