

Telecomm Tutor Bot

Course Name: Generative AI

Institution Name: Medicaps University – Datagami Skill Based Course

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Project Number: GAI-19

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Academic Year: 2022-2026

Problem Statement & Objectives

- 1. Problem Statement** - Telecommunication plans are complex and involve several factors, including data limits, roaming policies, Fair Usage Policies (FUP), billing cycles, add-on packs, pricing structures, and regulatory conditions.

Traditional telecom training systems use:

- Static study material
- Multiple-choice quizzes
- Manual evaluation

These methods have significant drawbacks:

- They cannot evaluate conceptual understanding
- They rely on keyword-based checking
- They do not provide detailed explanations
- They lack personalization
- They do not identify weak areas

There is a need for a smart AI-driven system that:

- Evaluates descriptive answers
- Understands telecom context
- Detects conceptual gaps
- Provides detailed feedback
- Adjusts questions based on performance

The Telecomm Tutor Bot is designed to overcome these issues using Large Language Models (LLMs), semantic search, and adaptive learning methods.

2. Project Objectives –

The main objectives of this project are:

- To develop an AI-driven educational bot for the telecomm domain
- To integrate a Large Language Model (LLM) for contextual answer evaluation
- To implement semantic search using vector embedding
- To provide detailed, concept-based explanations instead of simple scoring
- To track user performance and identify weak areas
- To implement adaptive question generation
- To design a scalable, secure, and modular system architecture

3. Scope of the Project –

Functional Scope

- Topic-based telecomm assessment
- Natural language answer submission
- AI-powered evaluation
- Weak concept detection

Technical Scope

- LLM integration (Google Gemini)
- Vector database (FAISS)
- Embedding model (Hugging Face)
- Secure session management

Operational Scope

- Academic telecom training

- Telecom employee upskilling
- Concept-based assessment system

Proposed Solution

1. Key features –

- AI-powered contextual answer evaluation
- Semantic search using vector embedding
- Telecomm knowledge base integration
- Adaptive question generation
- Detection of weak areas
- Detailed explanation generation

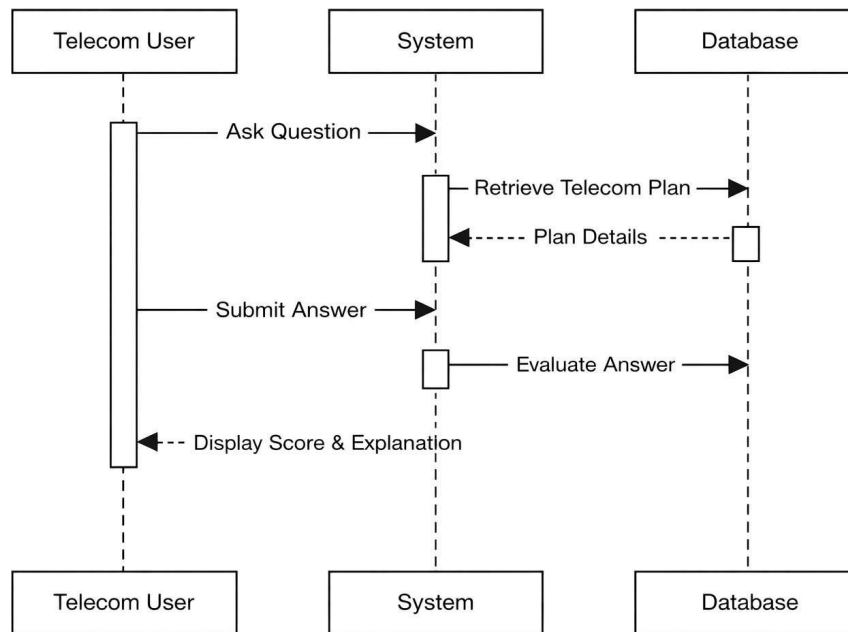
2. Overall Workflow –

- User selects a telecomm plan or learning module.
- System retrieves plan details.
- Generates question dynamically (rule-based or AI-assisted).
- User submits natural language answer.
- Prompt is constructed with:
 - Plan details
 - Correct answer reference
 - User response
- LLM evaluates the conceptual correctness.
- System generates:
 - Score
 - Correct answer
 - Detailed explanation

- Concept clarification

- Weak areas are identified.
- Adaptive follow-up questions are generated.
- User response and analysis are stored.
- Progress metrics is updated.

Sequence Diagram



The information flow ensures smooth data movement between system components.

1. Input Flow

User Input → Quiz Interface → Application Layer → Evaluation Engine

2. Evaluation Flow

Application Layer → Prompt Builder → LLM API → Evaluation Response

3. Feedback Flow

LLM Output → Explanation Formatter → Chat Interface → User

4. Data Storage Flow

Session Data → Database

5. Personalization Flow

Performance Data → Weak Area Detector → Adaptive Question Generator

The system maintains session state to ensure continuity while keeping AI evaluation calls independent and secure.

Key Design Considerations

1. Accuracy of Evaluation

- Context-based evaluation instead of keyword matching.
- Structured prompt templates for consistent LLM output.

2. Personalization

- Performance tracking per concept.
- Adaptive difficulty scaling.
- Reinforcement of weak areas.

3. Scalability

- Stateless AI API calls.
- Modular microservice-friendly architecture.
- Cloud deployment compatibility.

4. Security

- Secure API communication (HTTPS).
- Role-based access (if enterprise deployment).
- Data encryption at rest and in transit.

5. Reliability

- Fallback logic if LLM fails.
- Timeout handling.
- Logging and monitoring.

6. Maintainability

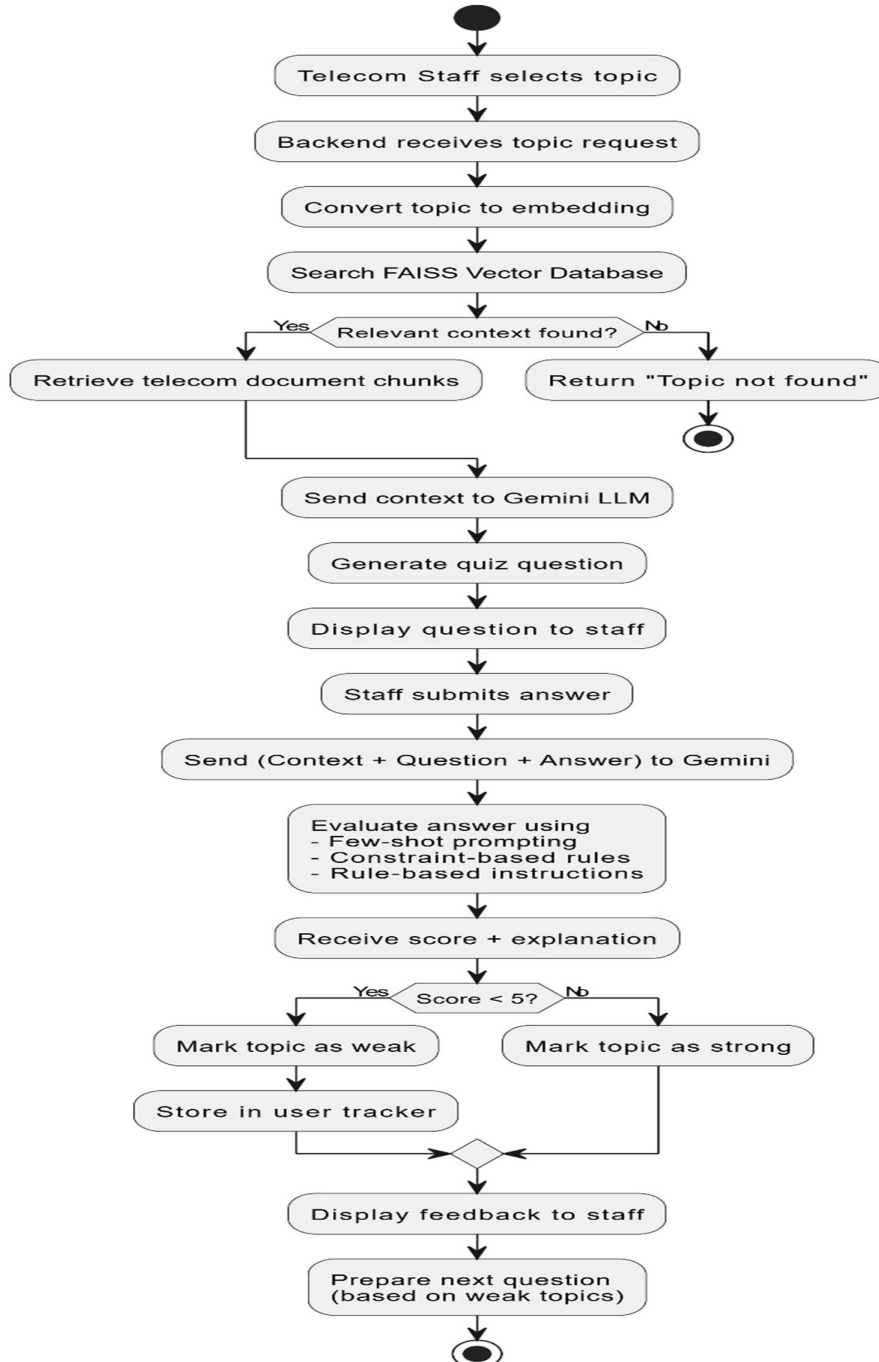
- Modular component separation.
- Configurable telecom plan datasets.
- Extensible question templates.

7. Performance Optimization

- Caching frequently used plan data.
- Response formatting optimization.
- Controlled token usage in LLM prompts.

Workflow Diagram

Telecom Staff Tutor Bot - Workflow Diagram

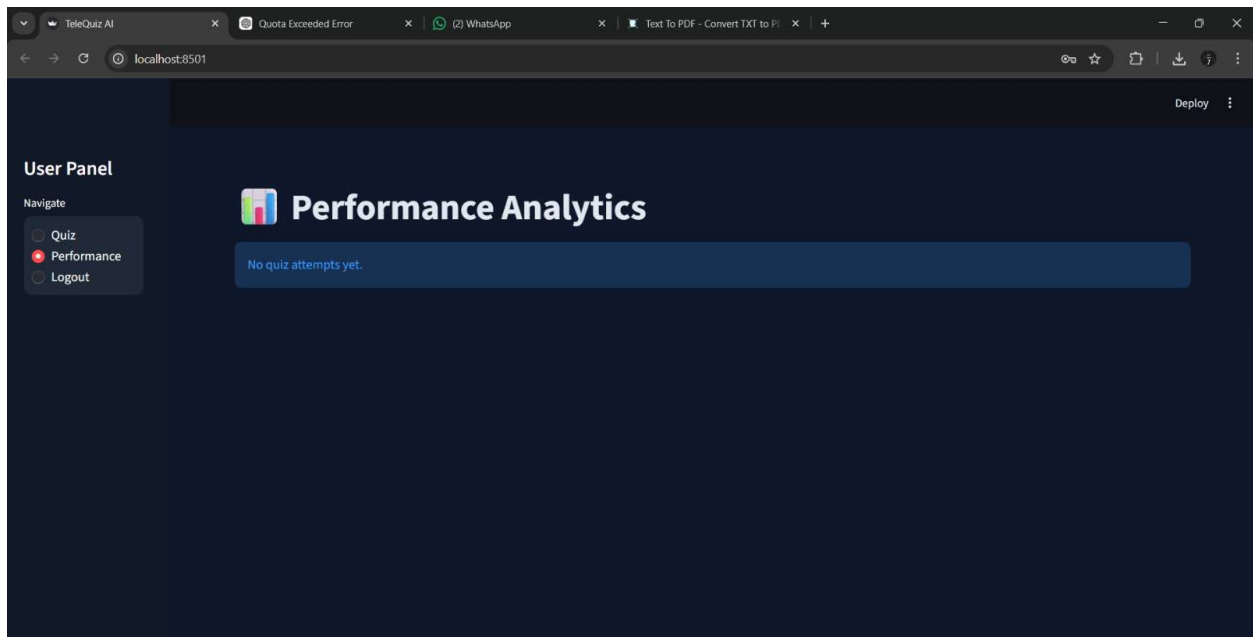


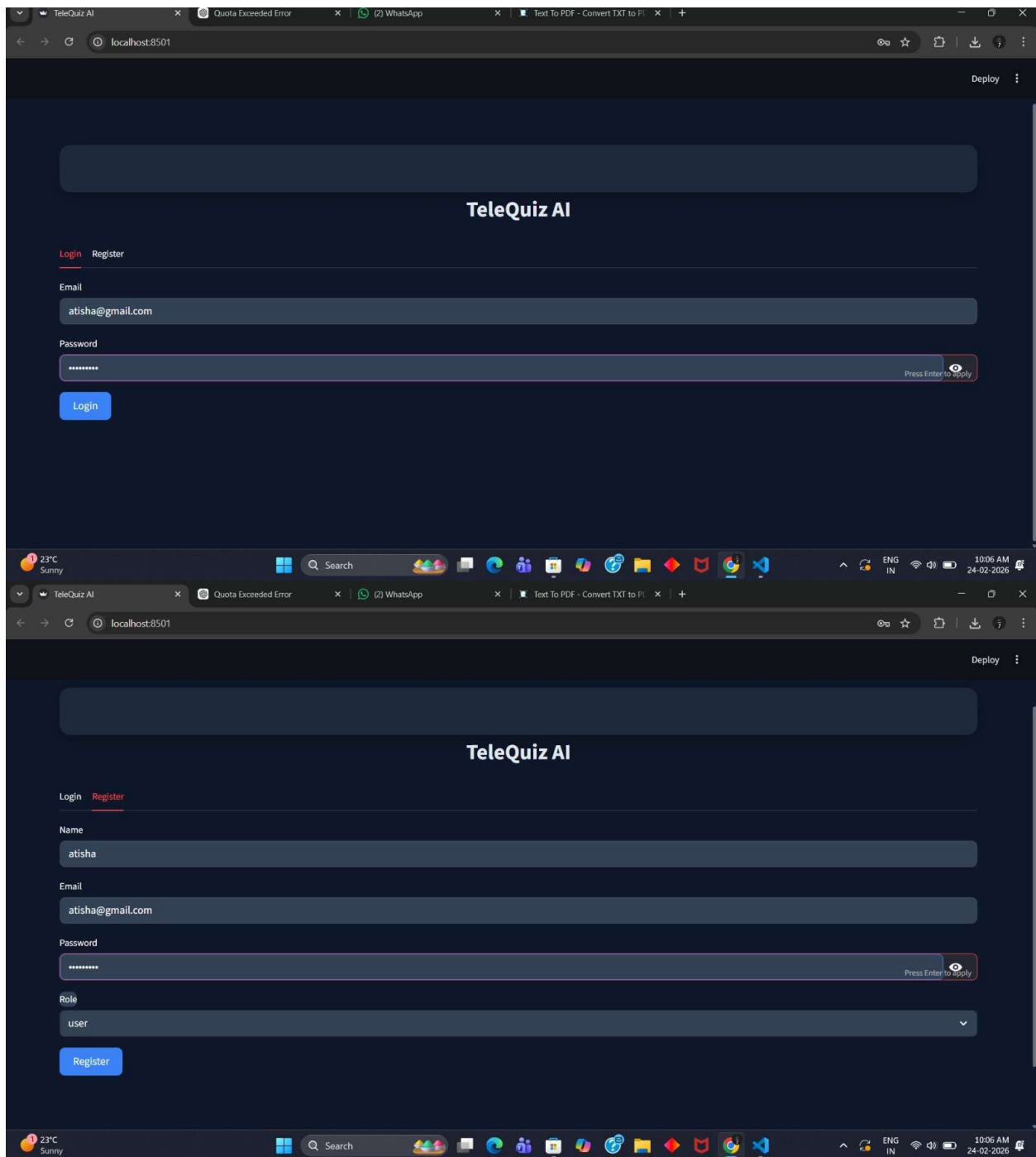
3. Tools & Technologies Used –

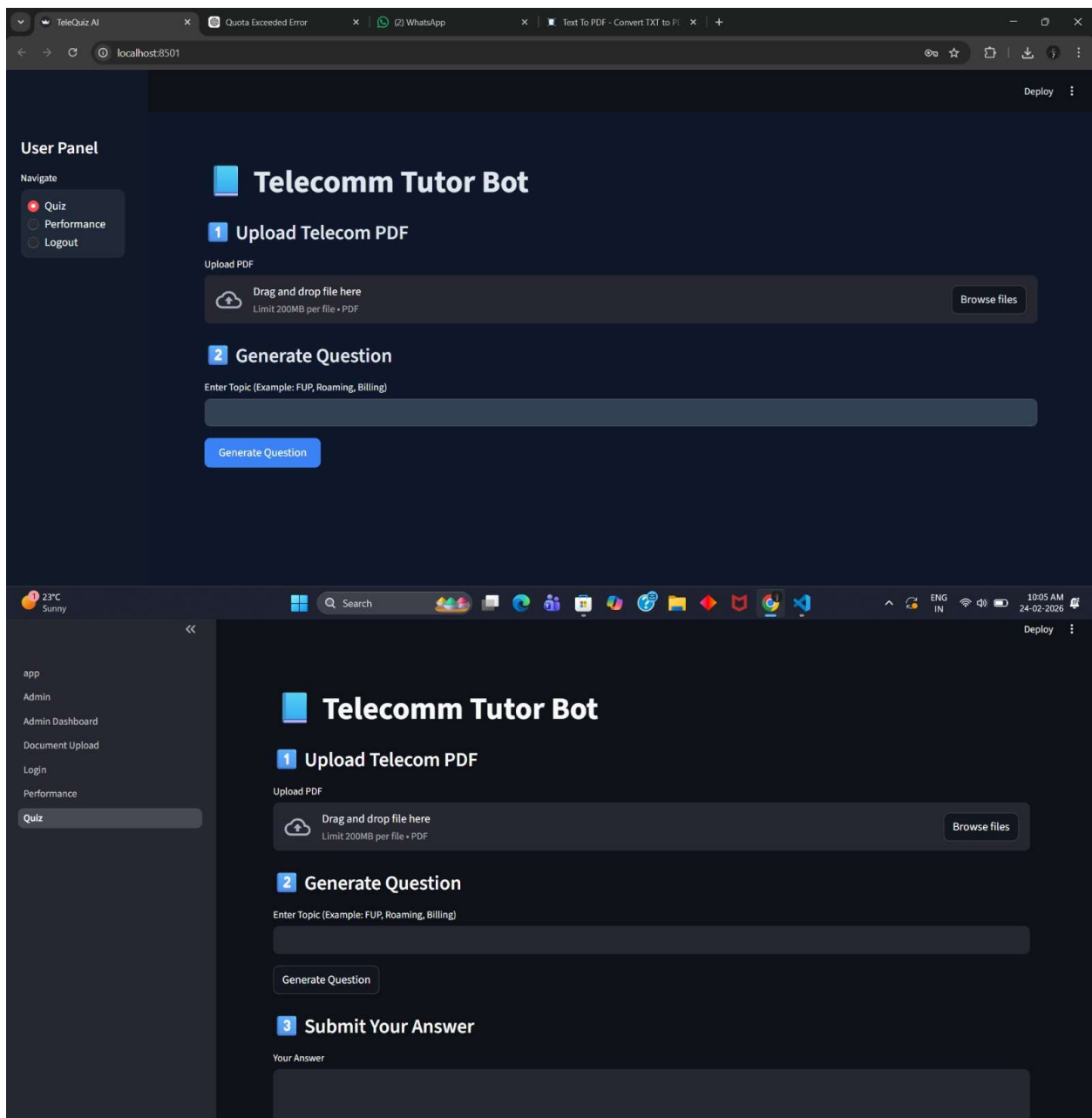
Technology Used	Purpose
Python	Backend development
Google Gemini API	LLM evaluation
Hugging Face Models	Embedding generation
FAISS	Vector database
Streamlit	Frontend interface

Results & Output

1. Screenshots / Outputs







Generate Quiz

Reference Content

Plan Name: Smart Plus Daily Data: 2GB Post Limit Speed: 64kbps Validity: 28 days Roaming Charges: ₹2 per MB FUP: Speed is reduced after daily quota. Voice: Unlimited local and national calls.

Plan Name: Smart Basic Daily Data: 1GB Post Limit Speed: 64kbps Validity: 24 days Voice: Unlimited SMS: 100 per day FUP: Internet speed reduces after 1GB.

Plan Name: Corporate Gold Monthly Data: 100GB Voice: Unlimited International Roaming: Enabled Roaming Charges: ₹1.5 per MB Validity: 90 days Additional Benefit: Priority customer support.

Plan Name: Corporate Platinum Monthly Data: 200GB Voice: Unlimited International Roaming: Enabled Post Limit Speed: 128kbps Validity: 180 days Additional Benefit: Dedicated account manager.

FUP Policy: Fair Usage Policy applies to all unlimited plans. Once daily or monthly data is consumed, speed is reduced. No extra charges are applied unless stated.

Roaming Policy: Roaming charges apply outside home network. International roaming requires activation. Incoming calls while roaming may be chargeable. Outgoing international calls are billed per minute.

Billing Information: Bills are generated monthly. Late payment attracts a penalty of ₹50. Services may be suspended after 15 days of non-payment. Refunds are processed within 7 working days.

SIM Activation: SIM activates within 30 minutes to 2 hours. KYC verification is mandatory. Customer must provide valid ID proof.

Plan Upgrade: Users can upgrade plans anytime. New plan becomes active within 24 hours. Previous balance does not carry forward.

Quiz Question

What happens to internet speed after the daily 2GB data limit is exceeded?

Your Answer

speed is decreased

Submit Answer

The system interface includes:

- Login page
- Topic selection interface
- Question display screen
- Answer submission interface
- AI-generated evaluation output
- Performance dashboard

Sample Evaluation Output

- Score: 7/10
- Correctness Label: Partially Correct

- Explanation :

The response correctly identifies the plan validity period but does not mention the applicable Fair Usage Policy limit. After 1.5GB/day, the speed reduces to 64 kbps as per policy.

- Weak Concept Identified: Fair Usage Policy (FUP)

2. Reports / Dashboards

The system generates:

- User performance summary
- Concept-wise score tracking
- Weak area detection report
- Session history report
- Mastery level indicator

Dashboard Indicators:

- Average score per topic
- Total attempts
- Weak concepts
- Improvement trend

3. Key outcomes –

- Successful implementation of semantic search for telecom documents
- Integration of LLM for contextual evaluation
- Development of an adaptive learning mechanism
- Achievement of a response time within (3–6 seconds)
- Construction of a secure, modular, and scalable system
- Demonstration of AI-driven personalized assessment

4. Implementation Details

This section describes the practical implementation of the Telecomm Tutor Bot.

4.1 System Development Approach

The project was implemented using a modular backend architecture with clear separation of concerns:

- UI Layer
- API Layer
- AI Integration Layer
- Data Management Layer

Development followed an incremental approach:

1. Telecom document ingestion
2. Embedding generation and FAISS indexing
3. Backend API development
4. LLM integration
5. Session management implementation
6. Performance tracking module
7. Testing and optimization

4.2 Telecomm Knowledge Processing

Step 1: Document Ingestion

Telecom plan documents (PDF/Text format) were uploaded into the system.

Step 2: Text Preprocessing

- Text cleaning

- Removal of formatting artifacts
- Splitting into logical chunks (paragraph-level segmentation)

Step 3: Embedding Generation

Each text chunk was converted into a vector representation using a Hugging Face embedding model.

Step 4: Vector Indexing

The embeddings were stored in a FAISS index to enable efficient semantic similarity search.

4.3 Question Generation Module

The system retrieves top-k relevant chunks from FAISS and uses:

- Rule-based templates
- LLM-assisted generation

to create contextual telecom-related questions.

4.4 LLM-Based Evaluation

The evaluation module constructs a structured prompt containing:

- Retrieved telecomm context
- Generated question
- User response
- Evaluation rules

The prompt is sent to the Google Gemini API.

The response includes:

- Numerical score (0–10)
- Correctness classification
- Detailed explanation
- Weak concept identification

The output is parsed and stored in the database.

4.5 Personalization Engine

The personalization logic tracks:

- Concept-wise score
- Attempt count
- Mastery level
- Weakness flags

Based on these metrics, the system adjusts:

- Question difficulty
- Concept repetition
- Reinforcement frequency

4.6 Session & Authentication Management

- Unique session ID generation
- Session timeout handling (15–30 minutes)
- Resume capability from last saved state

LLM calls are stateless, while session context is maintained at the backend.

4.7 Caching & Performance Optimization

The system implements:

- Telecomm chunk caching
- Embedding caching
- Session-level caching
- Analytics caching

This reduces repeated vector searches and minimizes LLM API calls.

4.8 Security Measures

- HTTPS-based API communication
- Secure storage of API keys in environment variables
- Role-based access control
- Encryption of sensitive data
- Controlled prompt construction to avoid hallucination

Conclusion

The Telecomm Tutor Bot is an AI-powered intelligent educational system designed to improve conceptual learning in the telecom domain.

The project successfully integrates:

- Vector-based semantic search
- Large Language Model evaluation
- Context-aware reasoning
- Adaptive learning mechanisms
- Secure backend architecture

Through this project, we gained practical knowledge in:

- LLM integration
- Prompt engineering
- Embedding models
- Vector databases
- Backend API development
- System design & architecture planning

The system demonstrates both strong architectural thinking and real-world AI implementation capability.

Future Scope & Enhancements –

- Adding voice-based question answering
- Supporting multilingual telecom training
- Implementing real-time telecom plan comparison

- Fine-tuning domain-specific LLM
- Deploying on cloud for enterprise scalability
- Adding advanced analytics dashboard
- Integrating gamification elements
- Adding mobile application support
- Using reinforcement learning for better personalization