Final Report
On
Telecom – Triage – Agent
(AAI-39)

Course Name: Datagami Skill Based Course
Institution Name: Medi-Caps University

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FOUNDATION & CONCEPTUAL FRAMEWORK

1.1 Introduction to the Telecom Industry Challenge

Telecommunication companies operate in a highly competitive and customer-sensitive environment. Every day, thousands to millions of customer complaints are received via:

- Email
- Chat support
- Call centers
- Mobile apps
- Web portals

Most of these complaints are unstructured text messages such as:

“My internet is not working since yesterday.”

“Recharge deducted but data not received.”

“SIM is not activating.”

Handling such a high volume manually causes operational inefficiencies.

1.2 Problem Context

Traditional support systems rely on:

- Human agents reading messages
- Manual tagging
- Manual routing
- Manual drafting of responses

Issues Identified:

1. High Response Time
2. Human Routing Errors
3. Inconsistent Tone of Communication
4. Increased Operational Cost
5. Poor Customer Experience

This creates a strong demand for an AI-based triage solution.

1.3 Need for Intelligent Automation

Modern AI systems powered by Large Language Models (LLMs) can:

- Understand context
- Extract structured information
- Generate professional responses
- Make intelligent routing decisions

Instead of replacing human agents, AI acts as a **support assistant**, handling the first layer of triage.

1.4 Project Vision

To design and implement a production-style telecom support triage agent that:

- Classifies complaint urgency
- Detects intent
- Extracts structured data
- Drafts professional telecom responses
- Routes issues automatically

1.5 Project Objectives

Objective 1: Complaint Classification

Detect:

□ Urgency → High / Medium / Low
□ Intent → Network / Billing / SIM / Others

Objective 2: Named Entity Recognition (NER)

Extract:

- Ticket ID
- Phone Number
- Dates
- Customer Name (if provided)

Objective 3: Response Generation

Create:

- Professional telecom-grade responses
- Polite tone

□ Action-oriented communication

Objective 4: Intelligent Routing

Automatically assign complaint to:

- Network Support Team
- Billing Support Team
- SIM Activation Team

1.6 Literature Review

Traditional Rule-Based Systems

Keyword matching systems:

- “internet” → Network team
- “bill” → Billing team Limitations:

- Fails with ambiguous sentences
- Cannot understand context

Machine Learning Models

Used algorithms like:

- Naive Bayes
- Logistic Regression
- SVM

Limitations:

- Requires labelled dataset
- Retraining required

Large Language Models (LLMs)

Modern solution:

- Context-aware
- Few-shot capable
- Can generate structured outputs

This project uses:

- LLaMA 3.1 via Groq API
- LangChain for orchestration

1.7 Scope of the Project

Included:

- Automated first-level triage
- End-to-end workflow
- UI integration
- Structured JSON validation

Excluded:

- Live telecom database integration
- Multilingual support
- Real-time CRM integration

TECHNICAL ARCHITECTURE & IMPLEMENTATION

2.1 Overall System Architecture

High-Level Architecture:

User
↓
Streamlit UI
↓
Backend (Python + LangChain)
↓
Groq LLM API
↓
Routing Logic
↓
UI Response

2.2 Detailed Pipeline Architecture

Step 1: User Interface Layer

- Built using Streamlit
- Accepts complaint text
- Displays structured output

Step 2: Classification Chain

Prompt Example:

"Classify the following complaint into urgency and intent..."

Output:

```
{
"urgency": "High",
"intent": "Network Issue"
}
```

Step 3: Entity Extraction Chain

Uses structured prompts to extract:

```
{
"ticket_id": "1234",
"phone_number": "Not Provided",
"date": "Not Provided"
}
```

Step 4: JSON Validation Layer

Regex ensures:

- Proper JSON structure
- No hallucinated format
- Consistent keys

Step 5: Response Generation

Prompt designed to:

- Maintain polite tone
- Be concise
- Be professional
- Mention next action

Step 6: Routing Logic

If intent == Network → Network Team
If intent == Billing → Billing Team
If intent == SIM → SIM Support

2.3 Technology Stack

Backend:

- Python 3.11
- LangChain
- Groq LLM API
- dotenv
- Regex

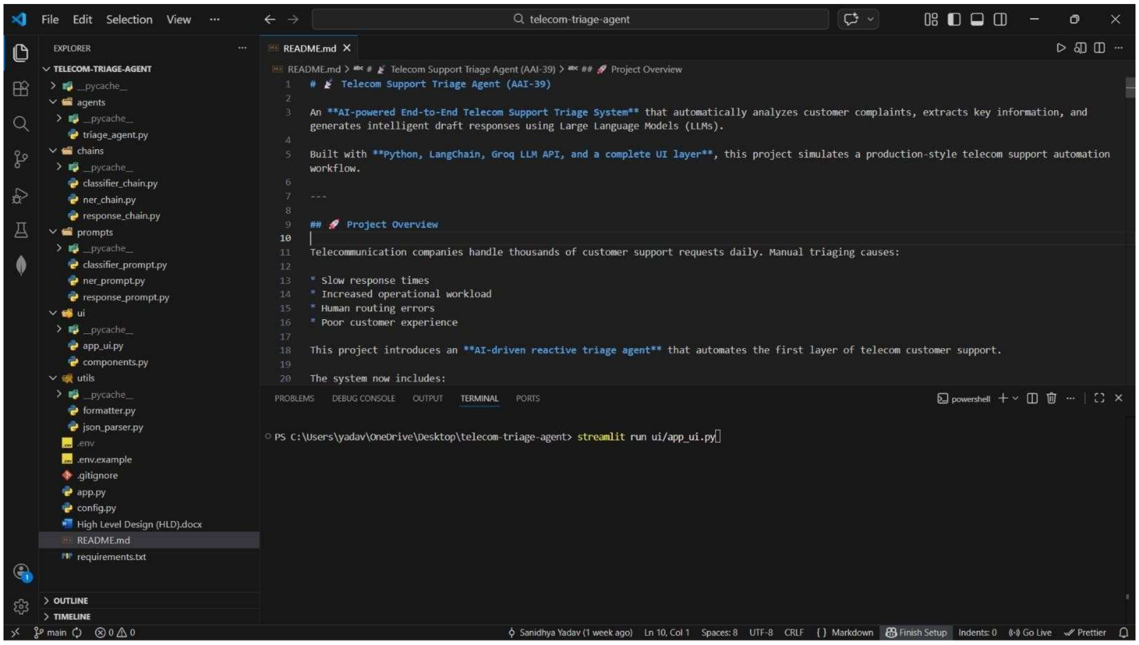
Frontend:

- Streamlit

AI Components:

- Prompt Engineering
- LLM-based classification
- Structured response generation

Screenshots / Output



```
# Telecom Support Triage Agent (AAI-39)

An **AI-powered End-to-End Telecom Support Triage System** that automatically analyzes customer complaints, extracts key information, and generates intelligent draft responses using Large Language Models (LLMs).

Built with **Python, LangChain, Groq LLM API, and a complete UI layer**, this project simulates a production-style telecom support automation workflow.

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## 🚀 Project Overview

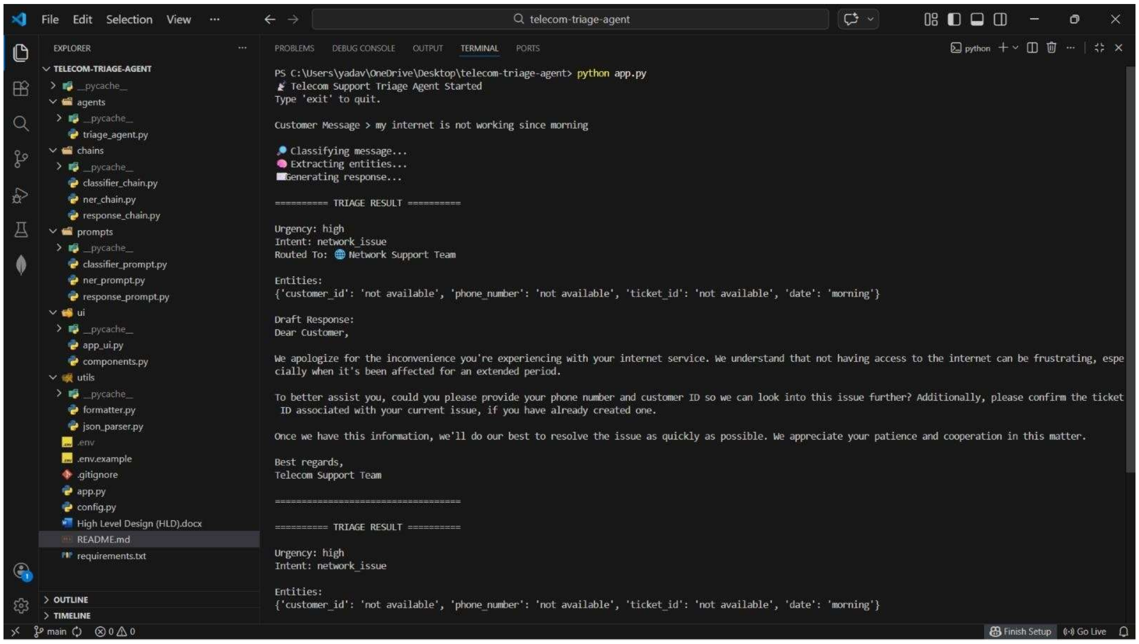
Telecommunication companies handle thousands of customer support requests daily. Manual triaging causes:

* Slow response times
* Increased operational workload
* Human routing errors
* Poor customer experience

This project introduces an **AI-driven reactive triage agent** that automates the first layer of telecom customer support.

The system now includes:
```

```
PS C:\Users\yadav\OneDrive\Desktop\telecom-triage-agent> streamlit run ui/app_ui.py
```



```
PS C:\Users\yadav\OneDrive\Desktop\telecom-triage-agent> python app.py
🚀 Telecom Support Triage Agent Started
Type 'exit' to quit.

Customer Message > my internet is not working since morning

🔎 Classifying message...
🧠 Extracting entities...
✉️Generating response...

========== TRIAGE RESULT ==========

Urgency: high
Intent: network_issue
Routed To: 🌐 Network Support Team

Entities:
{'customer_id': 'not available', 'phone_number': 'not available', 'ticket_id': 'not available', 'date': 'morning'}

Draft Response:
Dear Customer,

We apologize for the inconvenience you're experiencing with your internet service. We understand that not having access to the internet can be frustrating, espe
cially when it's been affected for an extended period.

To better assist you, could you please provide your phone number and customer ID so we can look into this issue further? Additionally, please confirm the ticket
 ID associated with your current issue, if you have already created one.

Once we have this information, we'll do our best to resolve the issue as quickly as possible. We appreciate your patience and cooperation in this matter.

Best regards,
Telecom Support Team

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========== TRIAGE RESULT ==========

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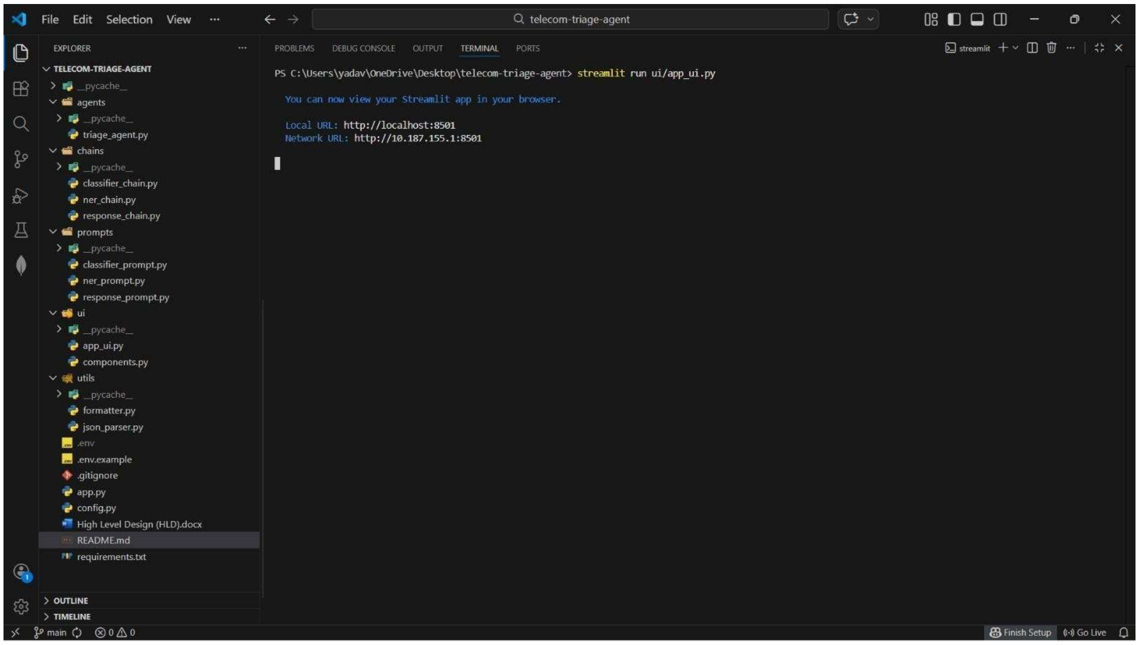
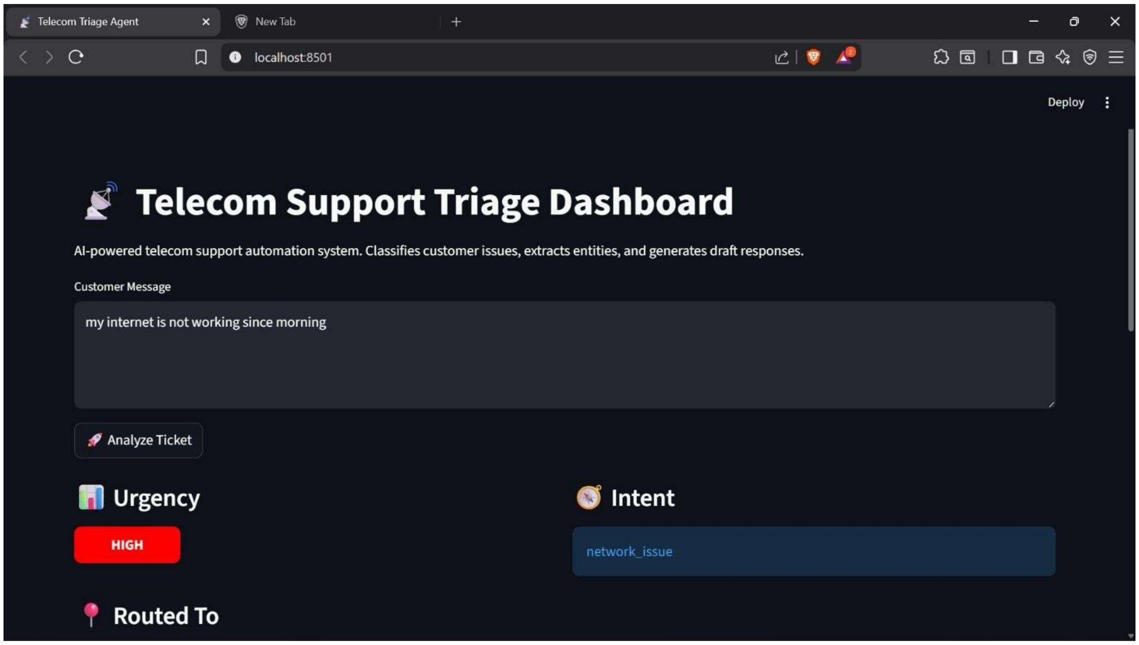


```
PS C:\Users\yadav\OneDrive\Desktop\telecom-triage-agent> streamlit run ui/app_ui.py

  You can now view your Streamlit app in your browser.

  Local URL: http://localhost:8501
  Network URL: http://10.187.155.1:8501

▌
```



Telecom Support Triage Dashboard

AI-powered telecom support automation system. Classifies customer issues, extracts entities, and generates draft responses.

Customer Message

my internet is not working since morning

🚀 Analyze Ticket

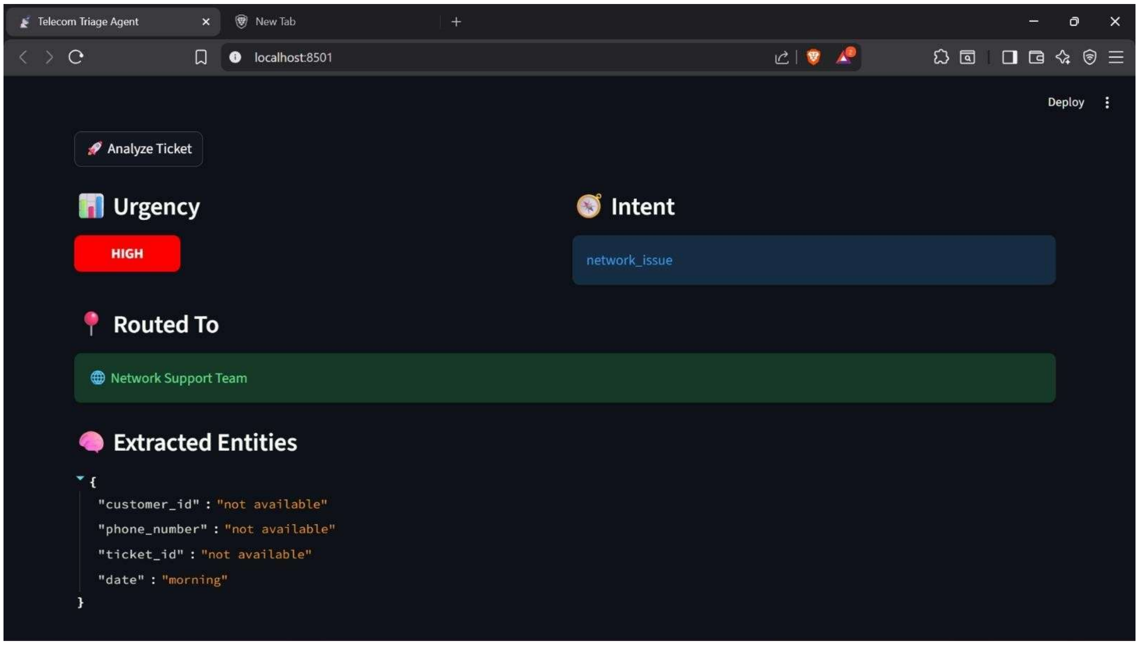
📊 Urgency

HIGH

🧭 Intent

network_issue

📍 Routed To



🚀 Analyze Ticket

📊 Urgency

HIGH

🧭 Intent

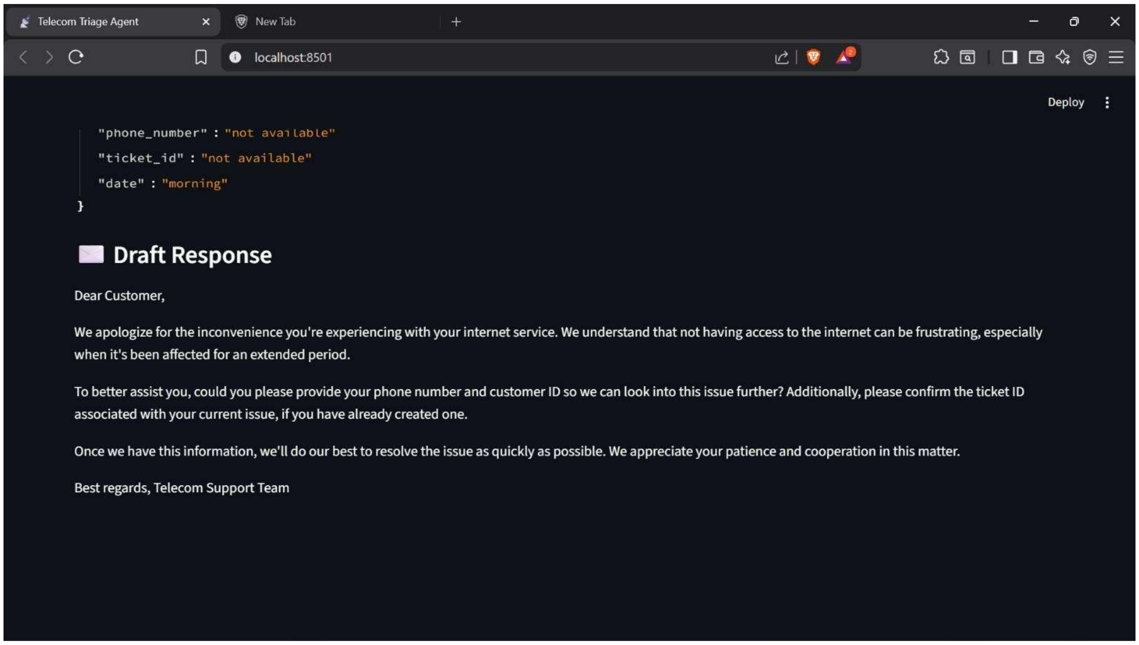
network_issue

📍 Routed To

🌐 Network Support Team

🧠 Extracted Entities

```
{
  "customer_id" : "not available"
  "phone_number" : "not available"
  "ticket_id" : "not available"
  "date" : "morning"
}
```



```
  "phone_number" : "not available"
  "ticket_id" : "not available"
  "date" : "morning"
}
```

✉️ Draft Response

Dear Customer,

We apologize for the inconvenience you're experiencing with your internet service. We understand that not having access to the internet can be frustrating, especially when it's been affected for an extended period.

To better assist you, could you please provide your phone number and customer ID so we can look into this issue further? Additionally, please confirm the ticket ID associated with your current issue, if you have already created one.

Once we have this information, we'll do our best to resolve the issue as quickly as possible. We appreciate your patience and cooperation in this matter.

Best regards, Telecom Support Team

2.4 Folder Structure

```
telecom-triage-agent/
├── agents/
├── chains/
├── prompts/
├── utils/
├── ui/
├── app.py
├── config.py This
```

ensures:

- Scalability
- Maintainability
- Modular testing

2.5 Data Flow Diagram

Customer Input
↓
Classification Module
↓
Entity Extraction
↓
Response Generation
↓
Routing
↓
UI Output

2.6 Security Design

- .env stores API keys
- .gitignore prevents key leakage
- Controlled prompts reduce hallucination
- Structured parsing ensures reliability

EVALUATION, RESULTS & FUTURE IMPACT

3.1 Sample Workflow

Input:
"My internet is not working since morning. Ticket #1234."

System Output:

Urgency → High
Intent → Network
Ticket ID → 1234
Routing → Network Team
Generated Response → Professional draft

3.2 Performance Analysis

Evaluation Metrics:

1. Classification Accuracy
2. Entity Extraction Accuracy
3. Response Coherence
4. Routing Correctness
5. Processing Time

Groq API provides low-latency inference.

3.3 Advantages of the System

- Faster response generation
- Reduced manual effort
- Improved customer satisfaction
- Modular scalable design
- Real-world applicability

3.4 Limitations

- API dependent
- No database persistence
- English-only support
- No live telecom integration

3.5 Business Impact

If deployed in telecom industry:

- 40–60% reduction in manual triage effort
- Improved SLA compliance
- Standardized communication
- Lower operational cost

3.6 Future Scope

1. Multi-agent system (CrewAI)
2. Conversation memory
3. CRM integration
4. Cloud deployment (AWS/GCP)
5. Analytics dashboard
6. Confidence scoring
7. Multilingual support
8. Real-time monitoring

3.7 Conclusion

The Telecom Support Triage Agent demonstrates how Generative AI and LLMs can automate real-world telecom workflows.

The system successfully integrates:

- Classification
- Named Entity Recognition
- Response generation
- Intelligent routing