

Bank Bot: An Intelligent Virtual Assistant for Banking Services

Architecture Document

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0.1 Introduction

The Bank Bot system architecture document provides a detailed overview of the system's structure, key components, and their interactions. This document outlines the modular design, technologies used, and the workflow that powers the Bank Bot system, focusing on how the user interacts with the bot and how data is processed, secured, and stored.

0.2 High-Level Architecture

The Bank Bot system follows a layered, modular architecture consisting of three primary layers:

- **User Interaction Layer:** This layer handles communication with the user. It provides a chat interface through which users can interact with the bot.
- **Processing Layer:** The core of the system, responsible for processing user inputs, NLP (Natural Language Processing), fraud detection, and other business logic.
- **Data Layer:** Responsible for managing and storing user data, transaction records, and other system-related data.

0.3 Component Overview

0.3.1 User Interaction Layer

The User Interaction Layer enables users to communicate with the Bank Bot through a user-friendly chat interface. It can be accessed via web or mobile platforms, where the user enters queries or requests for banking services. This layer interacts with the processing layer to route the user's requests appropriately.

0.3.2 Processing Layer

The Processing Layer is where the majority of the business logic resides. It includes the following key modules:

- **Natural Language Processing (NLP) Module:** This module is responsible for interpreting the user's input. It involves several steps such as tokenization, intent recognition, and named entity recognition to convert raw input into structured information.
- **Fraud Detection Module:** This module analyzes transactions to detect any potential fraud or anomalies in real time. It utilizes machine learning techniques such as anomaly detection to flag suspicious activities.
- **API Integration Module:** This handles communication with external banking systems, allowing the Bank Bot to retrieve transaction details, account balances, and other necessary data.

0.3.3 Data Layer

The Data Layer is designed to securely store and retrieve user information, transaction logs, interaction histories, and other data required for processing requests. It uses a relational database for structured storage and implements encryption and access control to safeguard sensitive information.

0.4 System Workflow

0.4.1 User Interaction Workflow

The workflow begins when a user submits a query via the chat interface. The interaction proceeds as follows:

1. The user submits a query through the web or mobile interface.
2. The query is sent to the NLP Processing Module, where the system interprets the intent of the query.
3. The system identifies the appropriate response and retrieves the necessary data from the backend services or external APIs.
4. The bot provides a response to the user in real time.

0.4.2 Fraud Detection Workflow

For fraud detection, the following steps occur:

1. Transaction data is continuously monitored by the system for suspicious activity.
2. Anomaly detection algorithms are applied to identify transactions that deviate from normal behavior.
3. If suspicious activity is detected, an alert is raised to notify the user and the system takes appropriate action to prevent fraud.

0.5 Database and Data Management

The Bank Bot uses a relational database to manage user profiles, transaction logs, and interactions with the system. The key features of the data management system are:

- **SQL Database:** For storing structured data related to user profiles, transaction records, and system logs.
- **Data Encryption:** All sensitive information such as user credentials and transaction records are encrypted using AES-256 encryption both at rest and in transit.
- **Backup and Recovery:** The system includes automated backup and recovery mechanisms to ensure data integrity and availability.

0.6 Security Considerations

Security is a critical aspect of the Bank Bot system, especially considering the sensitive nature of banking data. The key security features are:

- **Authentication:** The system uses OAuth 2.0 for secure authentication and authorization to ensure that only authorized users can access sensitive information.

- **Data Encryption:** All communication between the user, bot, and backend systems is encrypted using secure communication protocols (TLS/SSL).
- **Access Control:** Strict role-based access control (RBAC) is implemented to control which users and services can access specific parts of the system.

0.7 Technologies Used

0.7.1 Programming Languages and Frameworks

- **Python:** Used for backend development, NLP, and machine learning.
- **JavaScript:** Used for frontend development, enabling interactive user interfaces.
- **Flask:** A Python-based micro-framework for building the web service.
- **TensorFlow:** For implementing machine learning models for fraud detection.
- **SpaCy, Hugging Face:** Used for NLP tasks such as intent recognition and named entity recognition.

0.7.2 Cloud and Hosting

- **AWS:** Used for cloud hosting to ensure scalability and reliability.
- **Docker:** Used for containerization of services for easier deployment and scalability.
- **Git:** For version control and collaboration on development.

0.8 Modular Design and Scalability

The system is designed in a modular manner, with each module responsible for a distinct set of tasks. This modularity allows for easy scaling, such as adding new features, integrating with additional external APIs, or upgrading existing modules without affecting the entire system.

0.9 Future Enhancements

The Bank Bot architecture allows for flexibility in future enhancements, including:

- **Voice Interface Integration:** Addition of a voice-based interface for easier user interaction.
- **Multilingual Support:** Expanding support to multiple languages to cater to a broader audience.
- **Enhanced Fraud Detection:** Using advanced machine learning algorithms to improve fraud detection rates.
- **Cross-Platform Support:** Extending the system to work seamlessly across more platforms like smart devices, mobile apps, and desktops.