NLP Chatbot Development using Dialogflow

Software Requirements Specification

Version: 1.0

Group ID: F24PROJECT2A3F7

Supervisor: Abdullah Qamar

Revision History

Date	Version	Description	Author
13/11/2024	1.0	Initial SRS Document	Bc210412114

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Scope of the Project

Purpose

The project aims to design and develop a chatbot powered by Google Dialogflow to automate customer interactions for a restaurant. The chatbot will leverage Natural Language Processing (NLP) to understand user inquiries and provide accurate, context-aware responses. By automating routine tasks such as answering customer queries, managing reservations, and processing orders, the system will enhance both customer experience and operational efficiency.

Intended Functionalities

- **Automating Customer Interaction:** Without requiring human assistance, the chatbot will manage routine customer interactions including bookings, responding to inquiries, and offering assistance.
- **Task Handling:** For a Restaurant, the chatbot will manage table reservations, order-taking, menu navigation, and customer support.
- **Seamless User Experience:** The system will interact conversationally with users, ensuring that their needs are addressed quickly and efficiently.

- **Multi-Language Support:** The chatbot will support multiple languages to cater to a diverse user base.

System Capabilities

- **Natural Language Processing (NLP):** The chatbot will understand and interpret human language, using Google Dialogflow's advanced NLP capabilities to generate meaningful responses.
- **Backend Integration:** The system will connect to a backend (PHP/Python) for storing and retrieving data, such as reservation details, order information, or user queries.
- **Database Management:** The system will use MySQL to store user information, transaction logs, and system activities.

What the System Will Accomplish

- Automate repetitive tasks like responding to FAQs, processing orders, and handling reservations
- Improve response times by handling multiple users simultaneously with minimal latency
- Increase customer satisfaction by providing an always-available, interactive platform
- Enhance operational efficiency by reducing the need for human intervention in routine tasks

Limitations

- **Complex Queries:** The system is not designed to handle highly complex or ambiguous queries that require deep expertise or decision-making.
- **Medical Diagnoses:** In the Pharmacy Store case, the system will not provide any medical advice or diagnostic services—its role is limited to helping customers find products and set reminders.
- **Advanced Customer Service:** The system will not replace human representatives for complex customer service cases that require escalation.

Functional and Non-Functional Requirements

Functional Requirements

1. **Menu Browsing:** Allow customers to browse the restaurant's menu, categorized into sections such as appetizers, main courses, desserts, and beverages.
2. **Table Reservations:** Enable customers to check table availability and make reservations by selecting the date, time, and party size, ensuring a smooth reservation process.
3. **Order Placement:** The chatbot will facilitate order placement for customers.
4. **FAQ Handling:** Provide instant responses to FAQs, answering questions about the restaurant's operating hours, location, and special events.
5. **Database Integration:** Integrate with a MySQL database to store and manage menu items, reservation details, and customer orders.

6. **Multi-Language Support:** Support multiple languages, catering to a diverse user base and ensuring an inclusive user experience.

Non-Functional Requirements

1. **Scalability:** Handle multiple users simultaneously during peak hours without performance issues.
2. **High Availability:** Operate 24/7 with a minimum uptime of 99.9%.
3. **Response Time:** Provide fast responses, with a response time of no more than 2 seconds for user queries.
4. **Security:** Protect customer data through HTTPS encryption and secure database storage.
5. **Language Support:** Offer language-specific responses, enabling smooth communication in multiple languages using Dialogflow.
6. **Reliability:** Regular stress testing to minimize downtime during high-traffic periods.
7. **Maintainability:** Modular design that allows for quick updates to menu items, promotions, and features.
8. **Cross-Platform Accessibility:** Accessible across multiple platforms, including the restaurant's website, mobile app, and social media channels.
9. **User-Friendly Interface:** Simple interface with interactive elements like quick reply buttons for common tasks.
10. **Analytics Integration:** Track user interactions and gather insights for continuous improvement of services.

Use Case Diagrams

Use Case Diagram Description: Restaurant Chatbot System

The Restaurant Chatbot System is designed to streamline customer interaction with the restaurant, providing essential services such as menu browsing, table reservations, order placements, and frequently asked question (FAQ) handling through a conversational interface.

Actors

1. Customer

- Primary role: Interacts with the chatbot to perform various tasks related to restaurant services
- Use Cases:
  - Menu Navigation
  - Table Reservation
  - Order Placement
  - FAQ Handling

2. Administrator

- Primary role: Manages and monitors the restaurant chatbot's performance
- Use Cases:
  - View Reports

Use Cases and Relationships

- **Menu Navigation:** Enables customers to explore the restaurant's offerings and make informed decisions
- **Table Reservation:** Allows customers to book tables through the chatbot
- **Order Placement:** Provides a seamless ordering process after menu review
- **FAQ Handling:** Addresses frequent questions about restaurant policies, location, and information
- **View Reports:** Exclusive to administrators for reviewing performance and analytics

System Boundary

The Restaurant Chatbot System encompasses all use cases within the diagram, demarcating the interaction between external actors and system functionalities.

Usage Scenarios

Use Case Title	Use Case ID	Actions	Description	Alternative Paths	Pre-Conditions	Post-Conditions	Exceptions
Menu Navigation	UC-01	1. User opens chatbot 2. User selects "View Menu" 3. Chatbot displays categories 4. User selects category 5. Chatbot displays items	Allows customers to browse the restaurant menu interactively by categories	If user doesn't specify category, chatbot displays full menu	User must initiate interaction and request menu information	Menu details are displayed to user	If menu database unavailable, notify user and suggest trying later
Table Reservation	UC-02	1. User selects "Reserve a Table" 2. Chatbot prompts for details 3. User provides date, time, guests 4. Chatbot confirms availability	Enables users to book tables by specifying preferred time and party size	If requested time unavailable, suggest alternate slots	Reservation data must be up-to-date in database	Reservation recorded and confirmation sent	If database inaccessible, inform user of temporary issue
Order Placement	UC-03	1. User selects "Place an Order" 2. Chatbot asks for selection 3. User adds items to cart 4. User confirms order	Users can place orders for dine-in or takeout	If unavailable items added, suggest alternatives	Menu and order database must be functional	Order logged and confirmation sent	If order logging issues, apologize and redirect to support

Use Case Title	Use Case ID	Actions	Description	Alternative Paths	Pre-Conditions	Post-Conditions	Exceptions
FAQ Handling	UC-04	1. User asks question 2. Chatbot uses NLP to match query 3. Chatbot provides answer	Provides instant responses to frequently asked questions	If no matching FAQ found, prompt to rephrase or connect to support	FAQ database must exist in chatbot's knowledge base	User receives answer or is connected to human support	If FAQ database unavailable, provide contact details for manual assistance

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Adopted Methodology

Prototyping Model

The project will follow the Prototyping Model to quickly develop a working prototype of the chatbot and gather early feedback from stakeholders.

- Gather requirements by identifying core functionalities such as menu navigation, table reservations, order management, and customer support
- Develop a basic prototype using Google Dialogflow to demonstrate essential features
- Test the prototype with potential users and stakeholders to gather feedback and identify improvements

Incremental Development Model

The project will then adopt the Incremental Development Model to build and refine the chatbot in stages.

- Each feature will be developed and tested independently before integration
- Development sequence: table reservation → order management → customer support → promotional notifications
- Usability testing after each increment to ensure smooth integration
- Continuous testing and integration to maintain system stability
- Regular user feedback after each development stage
- Comprehensive testing including stress testing for the final version

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Work Plan

Project Phases and Milestones

Phase 1: Requirements and Design (October - November 2024)

- **SRS Development** (October 2024 - May 2025): Continuous refinement throughout project lifecycle
- **Scope Definition** (October 2024): Define clear objectives and boundaries
- **Requirement Gathering** (October 2024): Collect functional and non-functional requirements
- **Prototyping** (October 2024): Initial Dialogflow setup and basic functionality testing
- **Documentation** (November 2024): Complete functional/non-functional requirements, use case diagrams, and usage scenarios

Phase 2: Development (December 2024 - February 2025)

- **Backend Development** (December 2024 - February 2025): PHP/Python backend logic and Dialogflow integration
- **Frontend Development** (January 2025 - February 2025): HTML/CSS/JS user interface
- **Database Integration** (December 2024 - February 2025): MySQL setup and integration

Phase 3: Testing and Deployment (March - May 2025)

- **Design Document** (February 2025 - March 2025): Comprehensive system architecture documentation
- **Testing and Debugging** (March 2025): Prototype testing and bug resolution
- **Final Deliverable** (April 2025 - May 2025): System deployment and platform integration

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Technology Stack

- **NLP Platform:** Google Dialogflow
- **Backend:** PHP/Python
- **Database:** MySQL
- **Frontend:** HTML/CSS/JavaScript
- **Deployment:** Restaurant website, mobile app, and social media platforms

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Contact Information

For more information about this project, please contact the project supervisor or team members through the appropriate academic channels.