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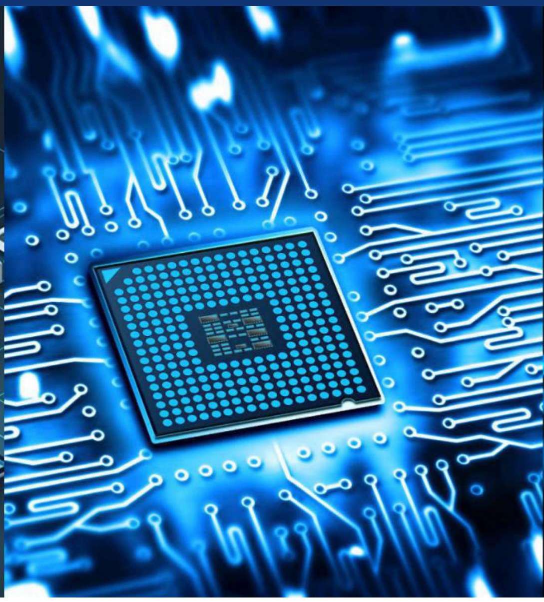

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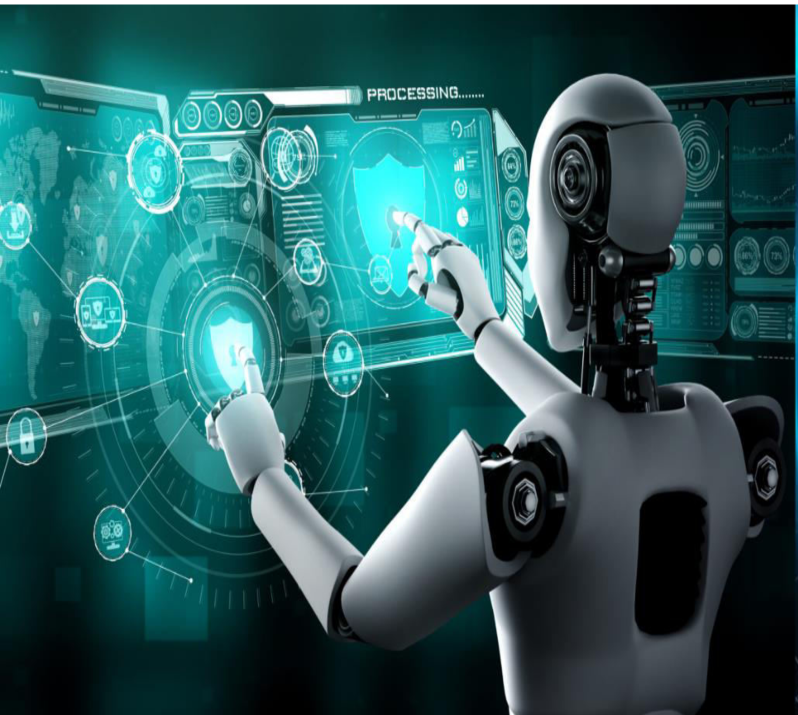

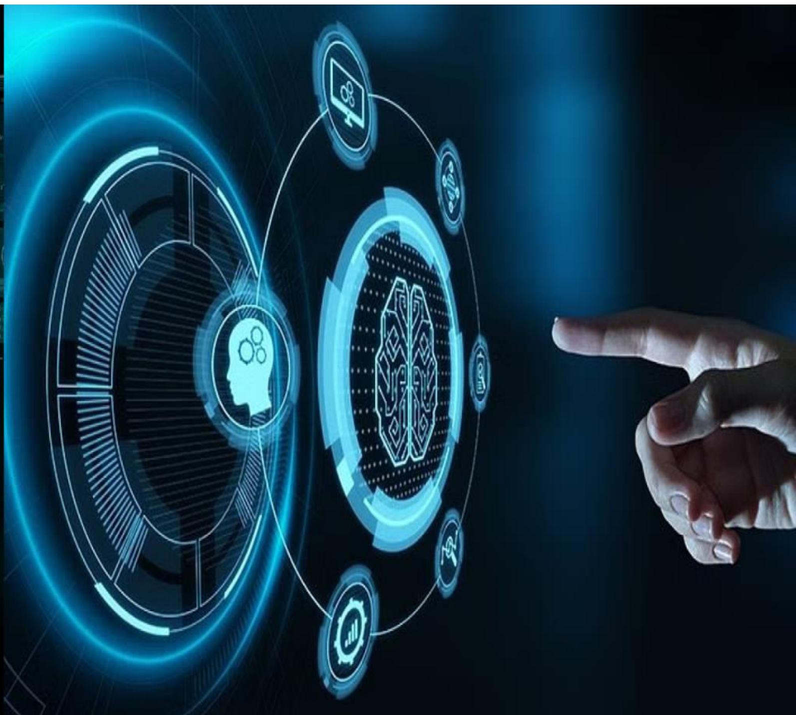

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Intelligent Chat Parser Based Smart Ordering System

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ABSTRACT: Many ordering systems fail to handle natural, multilingual, and unstructured user inputs effectively, especially when users mix regional languages with English. To address this challenge, this project presents an Intelligent Chat Parser based Smart Ordering System that understands user messages and converts them into structured order data. The system uses a generative AI model integrated with a FastAPI backend to analyze user input, extract product names, quantities, and units, and return a valid JSON response. It supports multilingual and transliterated inputs, performs semantic validation on units, handles ambiguity through clarification prompts, and safely rejects restricted items. The parsed orders are stored for further processing, while users receive conversational replies in their original language. This approach improves order accuracy, user experience, and system reliability in chat-based ordering environments.

KEYWORDS: Intelligent Chat Parser, Natural Language Processing, Multilingual Input Handling, Order Parsing, FastAPI, Generative AI.

I. INTRODUCTION

Digital ordering systems have become an essential part of the modern commercial world, especially in the food ordering and delivery business. Despite this, most of the current ordering systems are still based on menu-driven interfaces or keyword searches. These systems require users to conform to the system's language rather than the other way around. This problem is more common in regions with multiple languages, where customers often switch between regional languages and English while ordering.

In regions such as India, customers often use transliterated regional languages while ordering, which are typed using the English alphabet. For example, customers may use phrases such as "thakkali venum", "annachi palam", or "thanni one litre" while ordering. However, these phrases are difficult to understand using traditional ordering systems. As a result, customers are required to manually search for products, enter quantities, and manage their carts, which increases their effort and reduces their satisfaction.

Recent developments in Generative Artificial Intelligence and Large Language Models have demonstrated promising results in understanding contextual meanings, intentions, and variations in language.

Unlike traditional systems, generative models can understand unstructured inputs, remove ambiguities, and generate structured outputs when properly guided. This feature opens new avenues for the development of intelligent, conversational ordering systems that are similar to human-human conversations.

This paper presents an Intelligent Chat Parser-Based Smart Ordering System that allows users to order products using natural language. The proposed system supports multilingual and transliterated inputs, validates semantic meanings of quantities and units, and suggests recipe-based orders. Using a generative AI model and a FastAPI backend, the

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proposed system allows users to generate structured order data from unstructured messages while still interacting with the user in their native language.

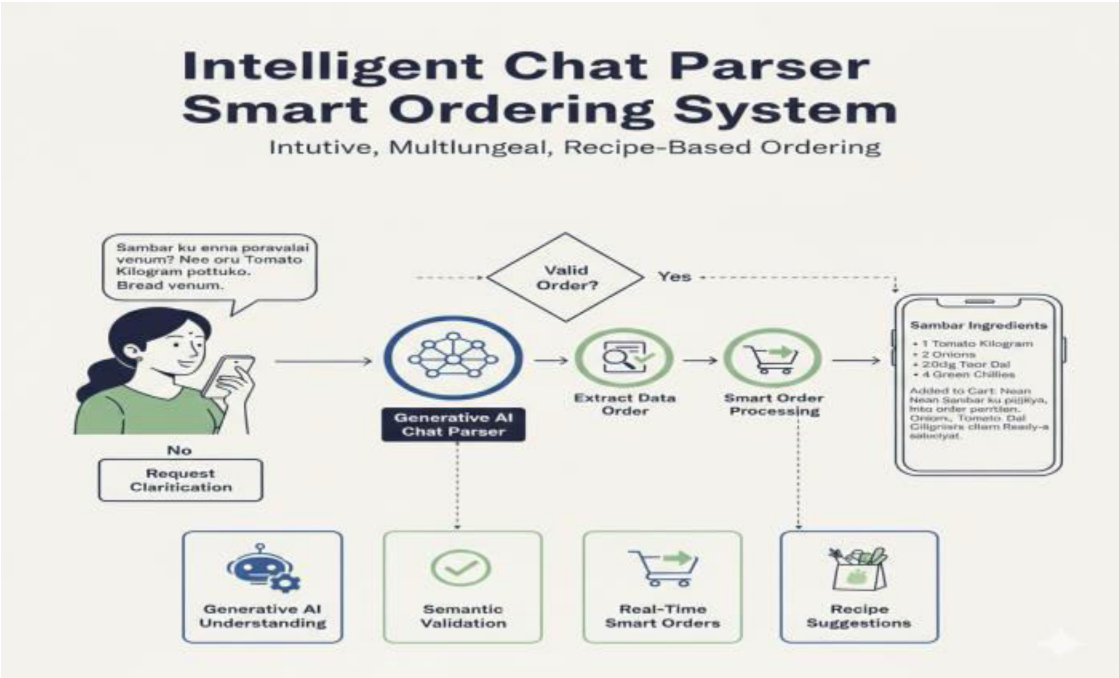

Figure 1.1: Smart ordering with AI chatbot

II. LITERATURE SURVEY

2.1 Natural Language Processing in Smart Ordering Systems

Natural Language Processing (NLP) is a crucial component that enables machines to process and respond to human language. In the early days of smart ordering and chatbots, NLP was achieved through rule-based techniques like keyword matching, pattern recognition, and decision trees. These systems worked well only when the user input conformed to pre-defined formats. Any variation in spelling, word order, and sentence structure often led to incorrect outputs or system crashes.

Later, statistical NLP techniques like n-grams and probabilistic language models were developed to make the systems more flexible. While these models made systems more tolerant of minor variations, they still did not have a strong semantic understanding of language. For instance, systems could recognize keywords like “rice” or “tomato” but could not deduce the user’s intent when the ordering was done in an indirect or chatty manner.

Recently, NLP systems based on neural networks have made considerable progress in detecting user intent and slot filling. These systems showed improved performance in extracting entities like product names, quantities, and units. Nevertheless, most of these systems were designed for monolingual data sources and performed poorly when users spoke multiple languages in a single sentence, which is quite common in real-world applications.

2.2 Task-Oriented Dialogue Systems

Task-oriented dialogue systems are intended to support users in accomplishing certain tasks like booking tickets, ordering, or fixing appointments. Conventional task-oriented dialogue systems are based on a strict pipeline of intent classification, entity extraction, dialogue state tracking, and response generation. Though this modular approach provides control and predictability, it requires a lot of training data and hyperparameter tuning for each domain.

Some research works have been proposed on dialogue systems for food ordering and shopping assistance based on supervised learning methods. These dialogue systems performed satisfactorily on accuracy metrics when trained on large amounts of annotated data. However, preparing high-quality labeled data for all languages and domains is a costly and time-consuming process. Moreover, these dialogue systems tend to perform poorly when presented with new phrases or informal usage of language.

Another drawback of traditional dialogue systems is that they are not capable of dealing with incomplete or ambiguous user inputs. Users tend to provide incomplete information, and the dialogue system is expected to fill in the missing information. For example, when a user utters “I want to make dosa,” the conventional dialogue system is not capable of automatically identifying the necessary ingredients without any additional user input.

2.3 Multilingual and Transliteration-Based Input Handling

Handling multilingual inputs is still a challenge in conversational systems. In multilingual communities, people tend to type regional languages using the English alphabet rather than writing in regional scripts. This transliteration results in multiple spelling variations for the same word, making it challenging for conventional NLP systems to handle them correctly.

Some researchers have tried to solve this problem using phonetic matching algorithms and transliteration dictionaries. Although these solutions work better than nothing, they are dependent on language resources and are not robust for informal spellings. Moreover, it is impractical to maintain dictionaries for all regional languages, adding to system complexity.

Recent works indicate that data-driven language models can learn implicit phonetic and semantic relationships without using explicit transliteration rules. These models show better performance in handling mixed language inputs and spelling variations. However, their use in real-time ordering systems with strict output requirements is still an uncharted territory.

2.4 Generative AI Models for Intent Understanding

Generative AI models are a revolutionary change in natural language understanding. Unlike conventional classification models, generative models process the entire input context and generate responses based on learned language patterns. This enables them to understand indirect intent, conversation context, and implicit meaning.

Studies have shown that generative models can be steered using prompt engineering techniques to generate structured outputs like tables or JSON objects. This enables them to seamlessly integrate with backend systems for automation tasks. Compared to conventional NLP pipelines, generative models require less task-specific training data and are more adaptable to new domains.

Although these models have numerous benefits, their initial applications were limited to text generation and question-answering tasks. Their use in transactional systems like ordering platforms has not been fully explored, especially regarding safety checks, semantic validation, and multilingual response consistency.

2.5 Semantic Validation in Ordering Applications

Semantic validation is critical for a smart ordering system that maintains logical relationships between products, amounts, and units. Research indicates that confusing units, like ordering liquids in kilograms or solids in liters, leads to operation errors and confuses the customer.

There have been proposals for rule-based validators to solve the above problem. However, they require a high degree of setup and don’t linearly scale for a broad variety of products. More flexibility is offered by machine learning validators. Still, they are also based on some form of rules.

Even integrating semantic validation into AI-powered parsing systems remains an open research problem. There are a handful of recent papers that explore the possibility of combining contextual understanding with domain expertise to detect ridiculous orders on the fly. However, such approaches have never been deployed widely in conversational ordering systems that face real-world limits.

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III. METHODOLOGY

3.1 System Architecture

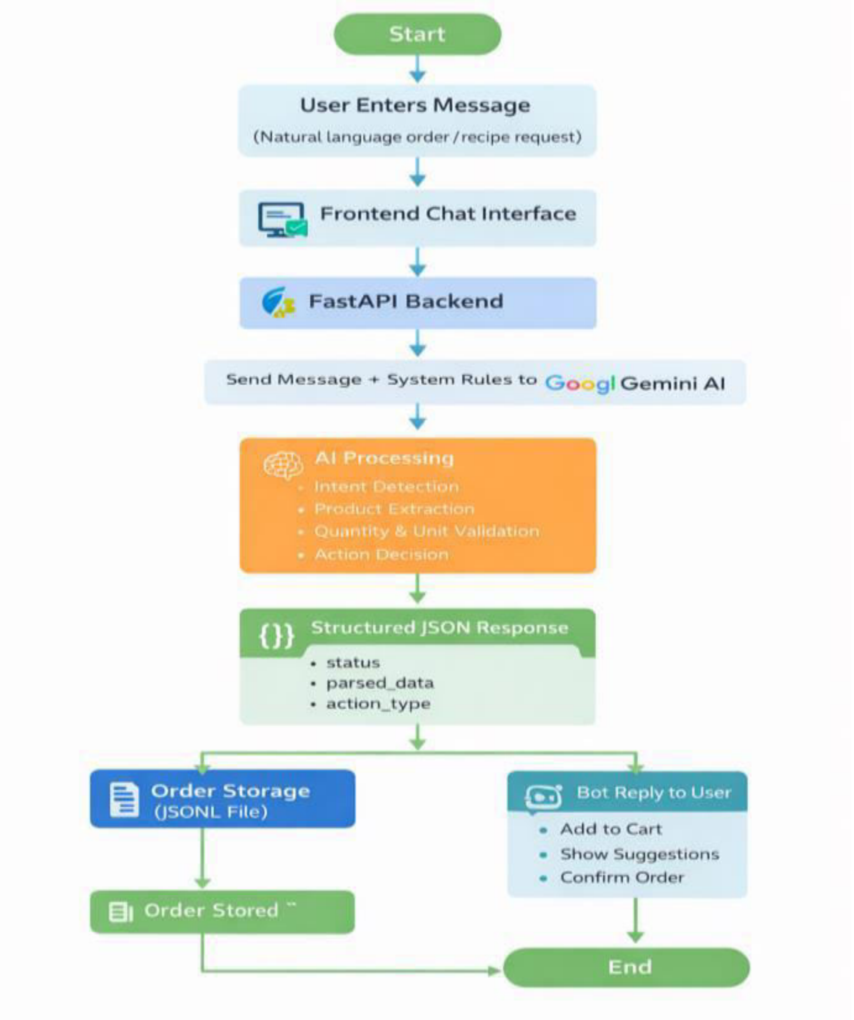

Figure 2: System Architecture

The diagram illustrates the complete operational flow of the Intelligent Chat Parser based Smart Ordering System, highlighting how a user's natural language message is transformed into a structured order and corresponding system action.

The process begins when the user enters a message in natural language. This message can be a direct product order (e.g., requesting specific items and quantities) or an indirect request such as a recipe or meal preparation query. The system is designed to handle both structured and unstructured inputs without requiring predefined command formats.

Once the message is entered, it is transmitted through the frontend chat interface, which serves as the interaction layer between the user and the backend system. The frontend is responsible only for capturing user input and displaying system responses, while all intelligence and decision-making are handled at the backend.

The captured message is then forwarded to the FastAPI backend, which acts as the central control unit of the system. The backend applies initial validation and forwards the user message along with predefined system rules to the Google

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Gemini AI model. These system rules enforce strict response formatting, safety constraints, semantic validation, and language consistency.

During the AI processing stage, the generative AI model performs multiple tasks simultaneously. First, it conducts intent detection to determine whether the user wants to add items, receive suggestions, or confirm an order. Next, it performs product extraction, identifying relevant items mentioned in the message, even when written in transliterated or mixed-language form. The model then validates quantity and unit consistency, ensuring that the order is logically meaningful. Based on this analysis, the AI determines the appropriate action decision.
The outcome of the AI processing is returned as a structured JSON response, which contains essential fields such as the processing status, parsed order data, and the identified action type. This structured output ensures seamless integration with backend logic and eliminates ambiguity in further processing.

Based on the action type specified in the JSON response, the system follows one of two execution paths. If the action involves adding items to the cart, the validated order details are saved in the order storage module, which uses a JSON-based file system for lightweight and persistent storage. Successful storage confirms that the order data has been securely recorded.

Simultaneously, the system generates a bot response to the user, which may include confirmation of added items, display of recipe-based suggestions, or final order confirmation. Importantly, the response is delivered in the same language as the user's input, maintaining conversational consistency and improving user experience.

The workflow concludes once the order is stored and the appropriate response is sent to the user, marking the end of a complete conversational ordering cycle. This architecture ensures efficient processing, scalability, and a natural user interaction flow while maintaining safety, accuracy, and semantic correctness throughout the system.

IV. RESULTS AND DISCUSSION

4.1 Design Methodology and System Functionality

The Intelligent Chat Parser powered Smart Ordering System is a system that seeks to allow individuals to converse with computerized ordering systems in a way that is more intuitive, as opposed to conventional designs that constrain users to converse in very particular ways using ordering commands or even specific ordering menus. The new approach abolishes limiting factors like syntax, spelling, or even use of more than one language when describing what is desired.

At its core, there is a generative AI, which is controlled and influenced by a well-thought-out system prompt. This prompt standardizes the output, such that all messages coming in from the user are systematically transformed into a machine-readable format. When a user sends a message, the system interprets it, identifying key elements in that message—for example, product names, quantities, and units, as well as deducing what the original intent of that message is. The intent-based system allows it to determine whether a user is making a product order, a recipe-based order, or confirming an order.

The process is also consistent with indirect ordering. You usually encounter such a case where there are hints of the ordering of meals or the idea of making a dish. The system intelligently knows the ingredients required while streamlining the process for maximum convenience with the automated selection of the items to order. There is a semantic check of the extracted data to ensure logic is consistent with the quantities with the appropriate units before an order is made.

Once the interpretation is validated, the system takes the correct action in real-time, which can be adding items to the cart, suggesting ingredient ideas, or confirming an order. The response is written naturally, using everyday language, and responds back in the same language as the user, which also helps in keeping it engaging. This brings us to a system that not only understands natural language but also ensures that it translates to an effective ordering process, thus suitable for a conversational commerce scenario.

V. MODULES DESCRIPTION

5.1 User Interaction Module

This component introduces a natural conversation interface, enabling the user to converse with it. It processes user inputs, sending them to the backend for handling. This component also includes input validation, which ensures that if the user does not input anything, it works correctly.

5.2 Order Understanding and Parsing Module

This section sends user messages to a generative AI model for interpretation, which recognizes fielded details such as the product name, amount, unit of measure, and if it is a selection. It also ensures that it responds in the user's chosen language. 6.3 Decision and Action Module On the basis of the intent analyzed by this module, further decisions regarding system responses are taken. Here, direct orders for products, recipe-based suggestions, and checkouts are handled. Semantic checks are applied to ensure illogical orders aren't made, and safety checks ensure restricted items are not purchased. 6.4 Order Storage Module When the orders are confirmed, they are stored using a JSONL file. In this file, each line corresponds to a particular order item. This means that while orders are being stored, the system remains lightweight and simple.

VI. CONCLUSION

The system has been put to task with various user inputs: direct commands, mixed-language phrases, and recipe-inspired requests. The system handled transliterated regional language input and generated accurate, formatted order data.

With this approach, compared to a traditional setup that is menu-driven, it cuts down the steps a user has to go through in placing an order. Recipe-based suggestions cut down on manual item picking. Conversational responses enhance the user's engagement and improve overall interaction experience.

This work describes an Intelligent Chat Parser-based Smart Ordering System that utilizes generative AI to provide natural, multilingual, and conversational ordering. It combines the seamless integration of a language model with a FastAPI backend and turns unstructured user input into structured order data, maintaining semantic accuracy and safety.

This approach increases the ease of access, reduces the effort by users, and improves the order accuracy, hence becoming quite practical for any real-world chat-based ordering platforms. In the future, this might be enhanced by introducing speech interactions, integration with the database, and support for more languages.

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