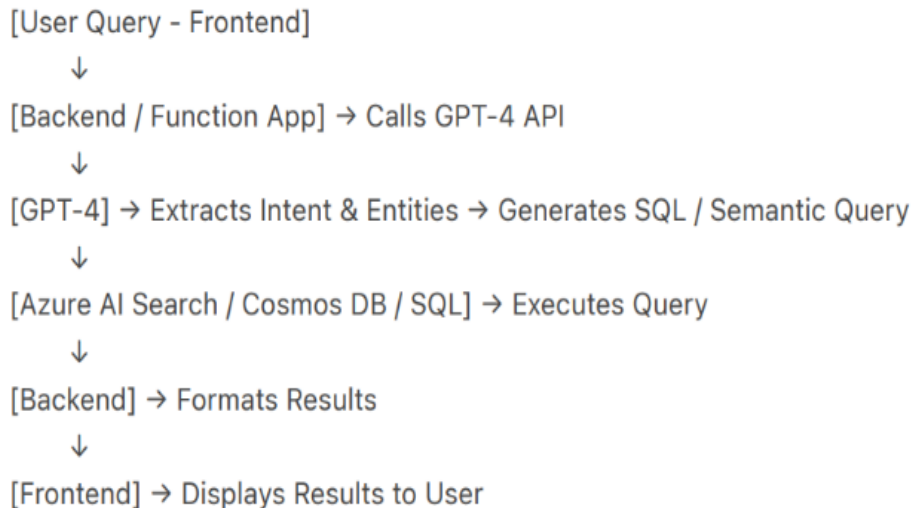


# NLP TO SEMANTICS UNDERSTANDING

## Workflow



## User Query (Input Layer)

- The user types or speaks a query in natural language.
- Example: "Show Marketing employees earning above 50k excluding interns."

This is the raw input that the system will understand and process. Queries can be complex or ambiguous, so the AI must handle synonyms, conditions, and context.

## NLP (Natural Language Processing Layer)

- Extract meaning, intent, and entities from the natural language query.
- Steps:
  - Tokenization: Break query into words or phrases. "Show", "Marketing", "employees", "above 50k", "excluding interns"
  - Part-of-Speech Tagging: Identify nouns, verbs, adjectives → helps GPT-4 understand roles of words.
  - Named Entity Recognition (NER): Detect entities like Department = Marketing, Salary > 50k, Role ≠ Intern.
  - Intent Detection: Determine the action the user wants → in this case, fetch employee records.

Without understanding the user's intent and entities, the system cannot generate correct structured queries.

## **Semantic Understanding Layer**

- Understand meaning, context, and relationships between entities.
- Example: User may write: "List all IT staff earning more than 60k" Semantic understanding allows the system to know: "IT staff" = "Information Technology employees" "more than 60k" = Salary > 60000

GPT-4 is used here because it can understand:

- Synonyms
- Multi-condition queries
- Context

## **Query Generation Layer (Semantic → Structured Query)**

- Convert the semantic understanding into a structured query (SQL / OData) that the database or Azure AI Search can execute.
- Process: GPT-4 receives intent + entities from NLP/semantic layer.

GPT-4 generates executable query

SELECT \* FROM Employee

WHERE Department='Marketing'

AND Salary>50000

AND Role<>'Intern'

## **Query Execution Layer**

- Run the structured query against Azure AI Search / Database.
- Process: SQL query executed → retrieves relevant rows Semantic search query executed → retrieves relevant documents or records based on meaning, not just keywords.

**Execution:**

1. Frontend / Web App – user types or speaks a query → sends to backend API
2. Backend / Function App – receives query → calls
3. GPT-4 API GPT-4 (Azure OpenAI Service) – processes the query:
  - Understands intent Recognizes entities
  - Handles context and synonyms
  - Generates a structured SQL / OData / Semantic Search query
4. Database / Azure AI Search – executes the query → returns results to backend → frontend. GPT-4 is integrated in the backend as a service/API call, not directly in the frontend or database.