

## **System Description**

Alice uses several Natural Language Processing techniques to deliver recipes to users.

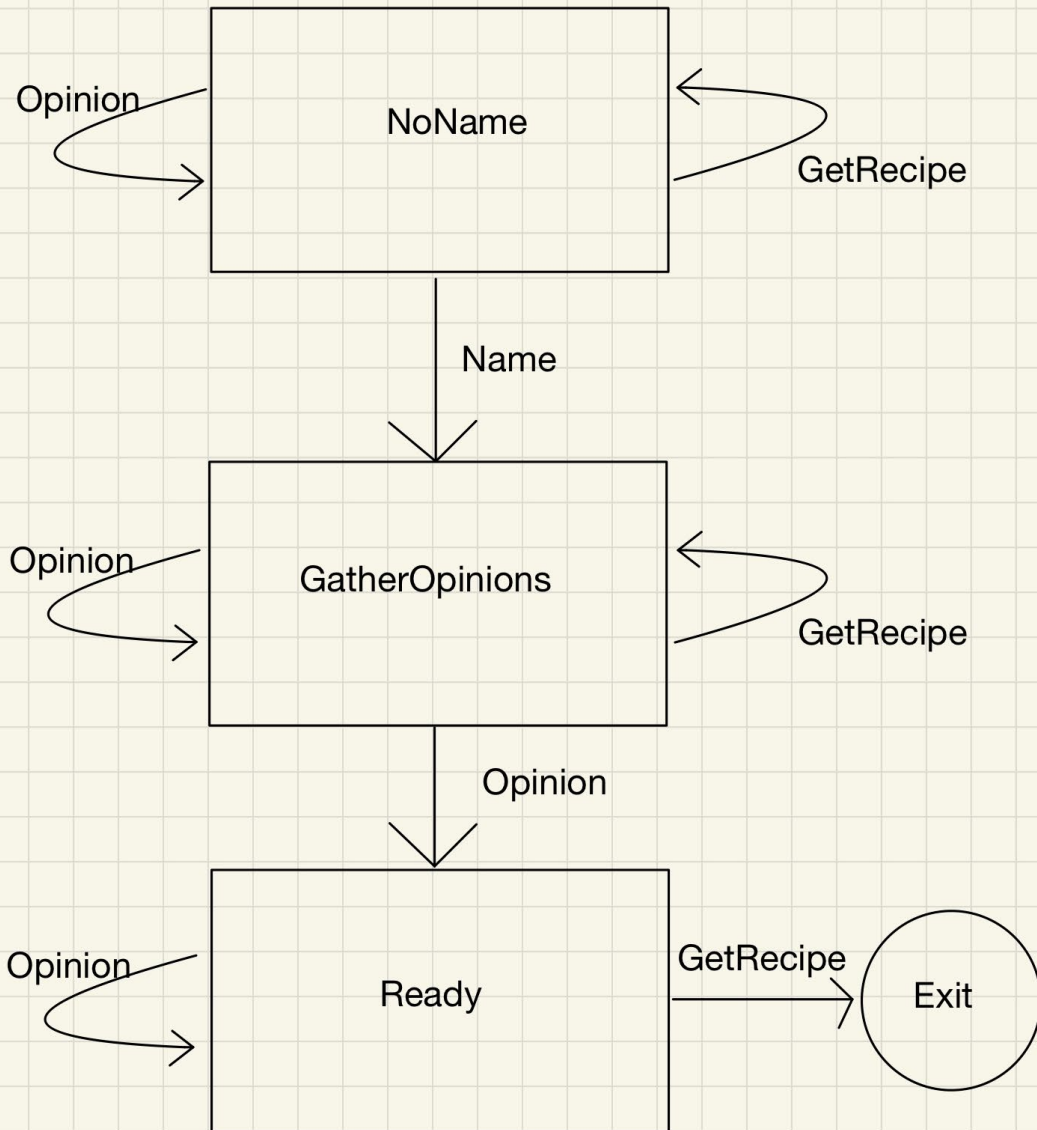
To determine intent, Alice attempts to shorten the user's sentence to three key words: a subject, a verb, and some object. Not all user input will populate these values. The bot maintains three lists of words for each of the three intentions (getRecipe, opinion, and name) that represent subject, verb, and object. When classifying a user utterance, all combinations of subject, verb, and object are generated for each intention and the shortened user message is compared to each combination. The combination with the greatest similarity to the shortened user message is selected as the likely intention.

Alice also uses a basic state machine that informs its intent classification. For example, if the user is prompted for their name, it is more likely that the next utterance will contain the user's name. This is represented by the confidence weights dictionary, which maps states to a set of weights to be added to the confidence scores of the different intentions.

If Alice classifies an utterance as having the "name" intention, it will perform POS tagging to find all proper nouns in the sentence. If there are none, Alice will ask the user to try again. If there are more than one proper nouns, Alice will ask the user which name they prefer.

If Alice classifies an utterance as having the "opinion" intention, it will use POS tagging to find all of the nouns in the sentence. It will then perform sentiment analysis on the utterance to determine how positive or negative the user's opinion is. For each noun, the sentiment analysis result is added to a dictionary in the user model.

If Alice classifies an utterance as having the "getRecipe" intention, it will interpret the sums of previous sentiment analysis in a binary way. Ingredients with a negative sentiment are added to a non-ingredients list and those with a positive sentiment are added to an ingredients list. These two lists are then used to query RecipeDB.



## Example Conversations

```
Hello, my name is Alice! What's your name?
> Hey, Alice, my name is Kim!
Okay, I'll call you Kim from now on.
Tell me about the ingredients you like, or don't like, in your food.
> I love apples.
I'll make sure to find recipes with that.
Tell me about the ingredients you like, or don't like, in your food.
> I think olives are disgusting.
Okay, I'll avoid those for now.
Tell me about the ingredients you like, or don't like, in your food.
> I really like pineapples.
I'll make sure to find recipes with that.
I think I've got enough here. Feel free to keep telling me your ingredient opinions, but I'm ready to find some recipes. Just ask!
> Sure, what can I make for dinner?
Let me take a look...
Searching for a recipe with ['apples', 'pineapples'] and without ['olives'].
I've found some recipes you might like!
This one is called Russian Honey Spice Cake. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100401
This one is called Sweet and Sour Cabbage. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100459
This one is called Black Bread (Bread Machine). You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100847
This one is called Danish Applesauce Cake. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100907
Thanks for talking to me! Goodbye!
```

```
> My name is Kim!
Okay, I'll call you Kim from now on.
Tell me about the ingredients you like, or don't like, in your food.
> I really like meat and potatoes.
I'll make sure to find recipes with that.
I think I've got enough here. Feel free to keep telling me your ingredient opinions, but I'm ready to find some recipes. Just ask!
> Sure, show me some recipes.
Let me take a look...
Searching for a recipe with ['apples', 'pineapples', 'meat', 'potatoes'] and without ['olives'].
I've found some recipes you might like!
This one is called Russian Honey Spice Cake. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100401
This one is called Sweet and Sour Cabbage. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100459
This one is called Black Bread (Bread Machine). You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100847
This one is called Danish Applesauce Cake. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100907
Thanks for talking to me! Goodbye!
```

```
Hello, my name is Alice! What's your name?
> I'm K
Okay, I'll call you K from now on.
Tell me about the ingredients you like, or don't like, in your food.
> I hate fruits and vegetables.
Okay, I'll avoid those for now.
Tell me about the ingredients you like, or don't like, in your food.
> I really like meat and potatoes.
I'll make sure to find recipes with that.
I think I've got enough here. Feel free to keep telling me your ingredient opinions, but I'm ready to find some recipes. Just ask!
> Sure, show me.
Let me take a look...
Searching for a recipe with ['meat', 'potatoes'] and without ['fruits', 'vegetables'].
I've found some recipes you might like!
This one is called Shchi; Russian Cabbage Soup. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100135
This one is called Crock Pot Russian Cabbage Soup. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100140
This one is called Saltwort- Hodgepodge (Solianka). You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100184
This one is called Macaroni Russian Navy Style- Stil Flota Russkogo Makaron. You can find the instructions to make it here: https://cosylab.iiitd.edu.in/recipeInfo/100196
Thanks for talking to me! Goodbye!
```

## Knowledge Base/Live Lookup

For my knowledge base, I chose to scrape RecipeDB, which is released under a noncommercial use license. When my chatbot needs to find recipes, it submits a POST request to the search page with the ingredients and non-ingredients as comma separated fields of the form. The resulting HTML is scraped for the table which contains the names of the recipes and links to view them. The link to RecipeDB can be found here: <https://cosylab.iitd.edu.in/recipeadb/>

Below is an example Postman request:

POST		https://cosylab.iitd.edu.in/recipeadb/search_recipe
Params   Authorization   Headers (8) <b>Body</b> Pre-request Script   Tests   Settings		
● none   ● form-data   ● x-www-form-urlencoded   ● raw   ● binary   ● GraphQL		
<input checked="" type="checkbox"/>	autocomplete_ingredient	apple
<input checked="" type="checkbox"/>	autocomplete_noningredient	potato
<input checked="" type="checkbox"/>	page	0

## Example User Models

The user model that Alice creates is relatively simple. The chatbot records the name and ingredient preferences of the user in a Python dict.

```
1  {
2      "name": "Kim",
3      "opinions": {
4          "apples": 0.5,
5          "olives": -1.0,
6          "pineapples": 0.2,
7          "meat": 0.2,
8          "potatos": 0.2
9      }
10 }
```

```
1  {
2      "name": "K",
3      "opinions": {
4          "fruits": -0.8,
5          "vegetables": -0.8,
6          "meat": 0.2,
7          "potatoes": 0.2
8      }
9  }
```

## Chatbot Evaluation

The chatbot performs surprisingly well given the lack of data. It is, for the most part, able to accurately classify user intent into “name”, “opinion”, and “getRecipe” and act on those intentions. The chatbot has access to a large knowledge base and is able to provide the user with desirable information relative to their expressed preferences. While the bot is largely unable to make sense of phrases similar to one of its intents, it provides the user enough feedback to effectively guide the conversation in an efficient manner.

The bot has some weaknesses, however. First, it is limited to processing one simple sentence at a time. While this in itself is not a breaking issue, it can be frustrating for users who want a faster conversation. Second, using similarity to find intent is limited and is only effective when the structure and wording of valid utterances vary greatly between intents. For example, the bot is capable of classifying the phrase “I think olives are disgusting” into the “opinion” intent, the statement “Beans are gross.” is classified as “name”, since both can use conjugations of the verb “to be”. Additionally, the sentiment analysis used to determine whether an opinion is positive or negative is relatively weak and, in some cases, result in an incorrect polarity. For example, the phrase “I really dislike potatoes.” is read as a positive statement, because “like” and “dislike” are not given significance by spaCy’s default semantic analysis, while “really” is given positive significance.

Although Alice is fully functional, a better intent classification scheme and a stronger sentiment analysis model would significantly improve the user experience.