

AI Chatbot For Job Interview

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Abstract—In this paper, we propose an interactive AI chatbot in French language which able to ask questions to a potential candidate, to detect incomplete answers and to ask additional questions in order to obtain a complete answer to a given question. Additionally, the proposed chatbot allows an interactive environment where candidates can also ask questions during the interview. We also propose a system of interview based on an exhaustive behavioral diagram. All the chatbot's functionalities have been validated by experimentation. The results show that our chatbot is complete in terms of the questions asked and information to be collected during the interview. Moreover, experimentation has shown that the diagram covers all cases of scenarios between an interviewer and a candidate during a job interview.

Keywords—NLP, interactive AI chatbot, job interview

I. INTRODUCTION

Research on the application of AI in the HR domain has been increasing in recent years [1]–[3]. The aim is to improve management processes and make it possible to abandon administrative and repetitive activities in favor of tasks with high added value [4].

AI is used in several HR activities such as employees training, detection of employees ready to resign and particularly in hiring process at different stages : candidate outreach [1], CV filtering [5], profile matching [6], job interview [7] and on-boarding [8]. Authors in [9] define the job interview as a personally interactive process of one or more people asking questions orally to another person and evaluating the answers for the purpose of determining the qualifications of that person in order to make employment decisions. Most of the work proposed in the literature in job interview aim to evaluate the candidate: sentiment analysis [10], skills evaluation and personality traits extraction [11], [12] and [13].

We can group these works in two main categories: deferred video job interview [14]–[16] and job interview chatbot [17]–[19].

In the first category, the candidate connects to the platform and will be filmed with a camera during the interview. The candidate's answers are recorded to be analysed after the interview. The second category is based on chatbots, a textual conversational agent, which interviews the candidate. The chatbot asks the questions to be answered by the candidate.

According to our knowledge, the chatbot based are facing with two main limits, as follows:

1) the lack of interaction with the candidate during

the interview: the interview questions are predefined. When the candidate answers a question, the answer is saved and the chatbot asks the following question regardless of candidate's answer. In order to achieve a more realistic interview, we propose an interaction between the chatbot and candidate.

2) the inability for the candidate to ask questions during the interview: the proposed recruitment chatbots do not allow the candidate to ask questions. We believe that giving the candidate this possibility is essential to make the interview becomes more close to a real interview.

To overcome these two limitations, we propose an interactive job interview chatbot based on AI techniques. This chatbot is able to interact with the candidate in real-time allowing the candidate to ask questions during the interview. We believe that it is important that the interviewer gives feedback to the candidate's answer and the latter can ask questions or request information from the interviewer.

The rest of the paper is organized as follows: Section 2 presents the proposed AI chatbot functionalities and diagram that structure the behavior of the chatbot during the job interview , Section 3 presents results of the experiments. Finally, Section 4 presents the conclusion and the perspective.

II. PROPOSITION

We propose an interactive chatbot that conducts a job interview with a potential candidate. The present paper does not aim to evaluate candidate's skills. Our goal is to collect as much information as possible about the candidate from his answers during the interview. We assume that nothing is known about the candidate prior to the interview. We do not take into account the information given on a CV.

During the interview, the chatbot must be able to ask questions to the candidate and answers the candidate's questions. The candidate answers the questions posed by the chatbot and can ask questions to the chatbot. Fig. 1 presents a comparison between a classic job interview chatbot and our proposed chatbot in this paper.

The design of our chatbot is based on 4 steps detailed below: definition of the questions to ask, definition of the intentions and entities to be extracted during the interview, candidate's actions during job interview and behavior of the chatbot during the job interview.

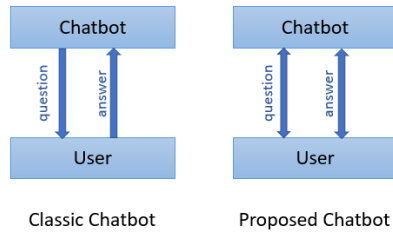


Fig. 1: Classic chatbot vs proposed chatbot.

A. Job Interview Questions

We structure the interview by “axis”. There are 6 axes with 2 greetings (welcome message and goodbye message): marital status, educational career, experiences, skills, languages and hobbies. Each axis contains a list of default questions to ask in an interview (It is the case when the candidate answers perfectly all the questions asked).

In contrast, in a real interview, the candidate might not understand a question asked or might answer the question asked partially. In the first case, the interviewer reformulates his question and in the second case he asks additional questions to obtain the missing part of the candidate’s answer.

For this reason, we define 3 types of questions to be asked by the chatbot:

- **Main questions** is a question asked by default to collect information from the candidate.
- **Reformulated questions** is a main question rephrased into another question when the candidate do not understand the main question
- **Additional questions** is a sub-question of a main question asked by the chatbot to recover the missing part of the answer.

B. Intentions and Entities

We propose a chatbot based on AI techniques. It relies on intent classification and entity extraction. For example, in Fig. 2 the candidate is answering a question. The chatbot can either move on to the next question, or ask a reformulated question or ask additional questions.

To match between questions, intents and entities, we defined for each question a list of intention which corresponds to a correct answer. If the classified intent is in this list the chatbot moves on to entity extraction. For each intent we have a list of entities to extract. Fig. 3 summarizes the match between questions, intentions and entities in the educational career axis.

C. Candidate Actions

Our goal is to offer the candidate a set of actions to allow him to interact freely with the chatbot. The interview begins with a greeting message sent by the chatbot. This message asks the candidate if they agree to be interviewed by the chatbot : "Hello, I'm your recruitment chatbot. Do you agree to start an interview with me?". Fig. 4 represents

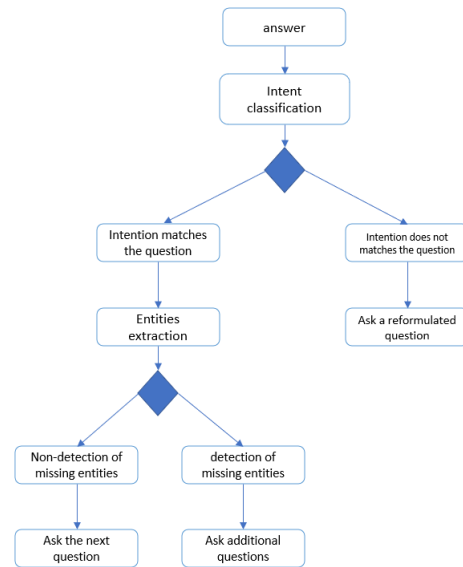


Fig. 2: NLP role in the conduct of the job interview.

the proposed actions the candidate can perform during the interview:

- **Accept interview:** allows candidate to accept the interview. The chatbot sends the first question.
- **Refuse interview:** allows candidate to refuse the interview. If so, the chatbot sends a goodbye message.
- **Answer a question:** allows candidate to answer the question asked by the chatbot
- **Refuse to answer:** allows the candidate to refuse to answer a question asked by the chatbot. The chatbot will move on to the next question. This action is necessary to not block the interview if the candidate does not want to answer a given question.
- **Ask a question:** allows candidate to ask a question to the chatbot. This action is important to make the interview close to a realistic interview.
- **Stop interview:** allows candidate to stop the interview

D. Chatbot Process Diagram

In this section, we propose a decision tree that represents the behavior of the chatbot during the recruitment interview. In order to cover all possible cases during an interview, we have generated effective scenarios. The idea is to vary as many scenarios as possible to take into account the different possible cases. Fig. 5 and Fig. 6 represent an example of generated scenario in French and English respectively.

From the generated scenarios and after 5 iterations, we propose the transition state diagram of the chatbot. The global process chatbot is given by Fig. 7. The job interview begins by sending the first question (greeting message) by the chatbot in B1. The chatbot receives the response and saves it in SD1. The intentions are processed in SD2, SD3 processes the control of the answer in relation to the question asked and the passage to the next question is processed in SD4. When the candidate answers the last

Axes	Main questions	Reformulated questions	Intentions	Entities	Additional questions	
axis 2 : educational career	diplômes	Q7 : Parlez-nous de votre dernier diplôme.	RQ7 : Quel est votre dernier diplôme obtenu ?	confirmer_diplome nier_diplome	intitulé_diplome spécialité_diplome organisme_diplome date_obtention	AQ7.1: Quel est l'intitulé de ce diplôme ? AQ7.2: Quelle est la spécialité de ce diplôme ? AQ7.3: Par quel organisme ce diplôme a été délivré ? AQ7.4: Quelle est la date d'obtention de ce diplôme ?
		Q8 : Avez-vous obtenu un autre diplôme ? Si oui, parlez nous de ce diplôme.	/	confirmer_diplome nier_diplome	intitulé_diplome spécialité_diplome organisme_diplome date_obtention	
	formations	Q9 : Parlez-nous de votre dernière formation.	RQ9 : Quelle est votre dernière formation obtenue ?	confirmer_formation nier_formation	intitulé_formation organisme_formation date_formation	AQ9.1: Quel est l'intitulé de cette formation ? AQ9.2: Par quel organisme cette formation est proposée ?
		Q10 : Avez-vous fait une autre formation ? Si oui, parlez nous de cette formation.	/	confirmer_formation nier_formation refuser_answer	intitulé_formation organisme_formation date_formation	AQ9.3: Quelle est la date de cette formation ?
	certifications	Q11 : Parlez-nous de votre dernière certification.	RQ11 : Quelle est votre dernière certification obtenue ?	confirmer_certification nier_certification	intitulé_certification organisme_certification date_certification	A11.1: Quel est l'intitulé de cette certification ? A11.1.1: Par quel organisme cette certification est proposée ?
		Q12 : Avez-vous une autre certification ? Si oui, parlez nous de cette certification.	/	confirmer_certification nier_certification	intitulé_certification organisme_certification date_certification	A11.1: Quelle est la date de cette certification ?

Fig. 3: Questions, intentions and entities defined in educational career

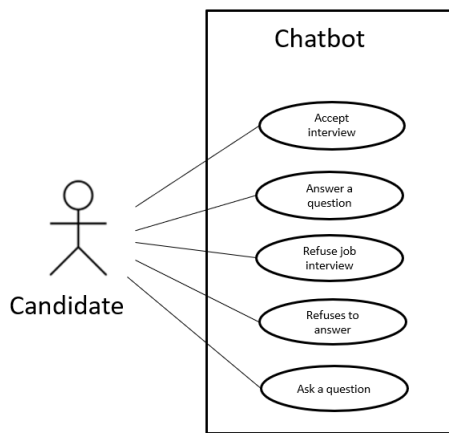


Fig. 4: Use case : candidate actions.

Q1: What is the last degree you obtained?
 R1: I don't have a degree, but I completed a training program in A in November 2021.

Q2: By which organization was this training program offered?
 R2: What do you mean by "organization"?

Q3: An organization or provider of training is an individual or legal entity that provides professional and continuing training services.
 R3: Oh, I see. It was offered by X.

Q4: Alright! Have you completed any other training programs?
 R4: No, I haven't.

Q5: Do you have any certifications? If yes, can you tell me about your latest certification?
 R5: No, I don't have any certifications. I forgot to mention that I completed a training program on C in October 2020. It was offered by Y.

Fig. 6: Example of a generated scenario translated in English.

Q1 : Quel est le dernier diplôme obtenu ?
 R1 : je n'ai pas de diplôme, j'ai une formation en A en novembre 2021

Q2 : Par quel organisme cette formation a été proposée ?
 R2 : Vous voulez dire quoi par organisme ?

Q3 : Un organisme de formation ou un dispensateur de formation, parfois appelé prestataire de formation est une personne physique ou morale qui réalise des prestations de formation professionnelle continu
 R3 : Ah ok, c'était proposée par X

Q4 : Bien ! Avez-vous fait une autre formation ?
 R4 : Non

Q5 : Avez-vous des certifications ? Si oui, parlez nous de la dernière certification ?
 R5 : non, je n'ai pas de certification. J'ai oublié de vous parler d'une formation que j'ai faite en octobre 2020. C'était une formation sur C proposée par Y

Fig. 5: Example of a generated scenario.

question, the chatbot sends a goodbye message and the interview ends.

The detailed process is given in Fig. 11. Sub-diagrams will be detailed below.

1) SD1: Receive and save the answer: A timer is activated when the chatbot is waiting for the candidate's answer. If the maximum duration is exceeded, the chatbot asks if the candidate wants a reformulation of the question (if he does not understand the question asked). If the answer is yes, connection to part SD3 is done to allow the chatbot to reformulate the question. Otherwise, the candidate's answer is saved and treated as a refusal answer.

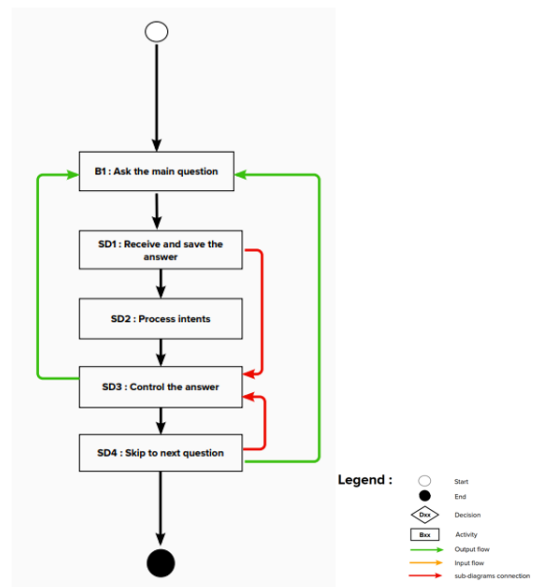


Fig. 7: Global process chatbot.

2) *SD2: Process intents*: The message intents sent by the candidate are classified by NLP intent classification model. A consistency check with the interview is carried out. If the intent is not adequate with the interview, the chatbot ignores it. Else, the intent can be of the 2 types:

- Informative: Answer to a question that the chatbot asked. Entities are extracted using NLP model.
- Information request: Question asked by the candidate. The chatbot saves the question, extracts the entities and prepares the answer.

3) *SD3: Control the answer*:

- If the candidate's message is an information request then the chatbot sends the information to the user.
- Otherwise, the chatbot checks if the answer corresponds to the question asked (response intent):
 - If yes : check response completeness
 - * If no entity is missing:
 - if no information request is recorded: switch to SD4
 - else: the information is sent to the user and we connect to SD1.
 - * else (some entities are missing): chatbot asks an additional question for each missing entity
 - Otherwise: chatbot finds that the answer does not correspond to the question asked, it reformulates the question

4) *SD4: Skip to the next question*: Chatbot checks that all the questions of the current axis are answered:

- If yes, the chatbot checks that all axes are processed:
 - If yes: the interview ends
 - Otherwise, the chatbot goes to the 1st question of the next axis and checks if there is already a complete answer to this question previously (this check is done in case the candidate has indirectly answered a question not yet asked, we believe that this question should not be asked again):
 - * If yes, connect to D12
 - * else, chatbot checks if part of the question has already been answered (if the candidate has partially answered a question not yet asked, the chatbot does not ask the main question again but he asks additional questions):
 - If yes, switch to SD2 to ask additional questions on missing entities
 - Otherwise, ask the next question (B1)
- otherwise, skip to the next question

III. EXPERIMENTS

The main of the experiments is to evaluate the completeness of our list of intents and entities to be detected in the interview and to check if our chatbot can conduct any type of interview by following the chatbot process diagram.

Population: 5 volunteers took part to the experiment, aged between 25 and 45 with various profiles (students,

developers, project managers, etc.). The experiment took place in 3 stages:

Step 1: generation of interview scenarios. In this step, the participants generate a set of scenarios that will be used in the following steps. 16 job interviews were generated on the 6 axes of the interview.

Step 2: manual extraction of intents and entities for each candidate's answer in the interview.

The aim of this step is to verify the completion of the list of intents and entities the chatbot is going to detect. For this, we asked the participants to extract the intention and the entities of each answer. An example is given in Fig. 8.

Recruteur	Candidat	Intentions (entités)
Monsieur Dubois, vous postulez pour un poste de chef d'équipe de "poseurs de fermetures en bâtiment". Quel est votre niveau de formation.	Je n'ai pas de diplôme mais j'ai suivi un apprentissage chez un artisan pendant 3 ans.	nier diplôme Donner information sur apprentissage (employeur = artisan, durée = 3 ans)
Où avez-vous fait cet apprentissage ?	Dans la région des Baux de Provence, car c'est une région où il y a un grand savoir faire et beaucoup d'artisanat. Je l'ai fait chez un ami de mon père, lui-même dans la serrurerie.	Donner information sur lieu et contexte apprentissage (lieu = Baux de provence ; métier=serrurerie).
A très bien, et quelles spécialités avez-vous pu étudier ?	J'ai pu apprendre et m'exercer sur toutes les spécialités de pose de serrure, façonnage de clés et de gonds, de conception de portes et volets en bois, en alu et en PVC.	Donner information sur spécialités étudiées (spécialités = pose de serrure, façonnage de clés et de gonds, de conception de portes et volets en bois, en alu et en PVC).

Fig. 8: Manual intents and entities extraction Example.

Step 3: projection of the interview in the diagram

The objective is to verify that the diagram contains all possible cases and to detect blockages in the diagram projection with scenarios generated in Step 1. For this, the participants projected the interview on the diagram. We asked the participants to present their projections in a table as represented by Fig. 9.

Q/R	objet parcouru	label transition
Début		
Q1	B1	
R1	B2	
	B3	
	D1	Non
	D2	Oui
	D4	Informatif
	B5	
	D1	Oui
	D3	Non
	D5	Oui
	B10	
	D8	Aucune
	D7	Non
	B12	Non
	B14	
	D14	Non
	D15	Non
Q2	B1	
R2	B2	

Fig. 9: Diagram projection example.

The objective of the experiment is to test the completeness and validity of the intentions, the entities expressed in the candidate's answers in an interview, and the chatbot process diagram.

The results show that the proposed intentions and entities are very close and even identical to those found in the experiment. We have not detected any intent or entity not taken into account in the predefined list. This shows that the chatbot can cover any job interview with a potential

candidate. The results also show that the diagram can be used as a generic structure for job interviews. All the scenarios generated have been projected on the diagram without any blocking. This shows that the proposed diagram can represent the behavior of the chatbot during a job interview.

A first chatbot demonstrator on the civil status axis is developed using Rasa [20] platform : DIETClassifier for intent classification and CRF (Conditional Random Fields) [21] model for entity extraction. The implementation of the other axes is in progress. Fig. 10 shows a screenshot of a user's conversation with the chatbot. In this example, the user gives an incomplete answer on the postal address where the postal code is missing. The chatbot asks him an additional question about the postal address.

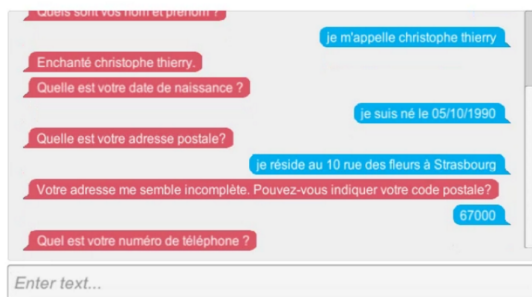


Fig. 10: Example of conversation with Job interview chatbot using RASA.

IV. CONCLUSION AND PERSPECTIVES

In this paper, we present an AI chatbot based on NLP techniques for job interview. We have defined the chatbot and represented its behavior during a job interview with a state transition diagram and presented also a demonstrator.

Diagram allows chatbot to:

- ask questions to candidates
- detect if the answer corresponds to the question asked
- detect if the answer given by the candidate is complete
- answer the questions asked by the candidates

The results show that the diagram, intents and entities cover thoroughly the different scenarios.

To the best of our knowledge, no job interview chatbot exists in the literature that has the defined functionalities of the chatbot proposed in this article. The only work that asks the questions according to the answer given by the candidate is [22]. Authors use follow up questions by detecting key words in the candidate's answer. However, it does not allow the candidate to ask questions during the interview. Further, in [22], authors use an android robot to implement their job interview and we are using a chatbot.

As a perspective, we have planed to finalize the implementation of our AI chatbot and test it in job interviews with potential candidates and evaluate the different func-

tionalties. The final results will be presented in a future paper.

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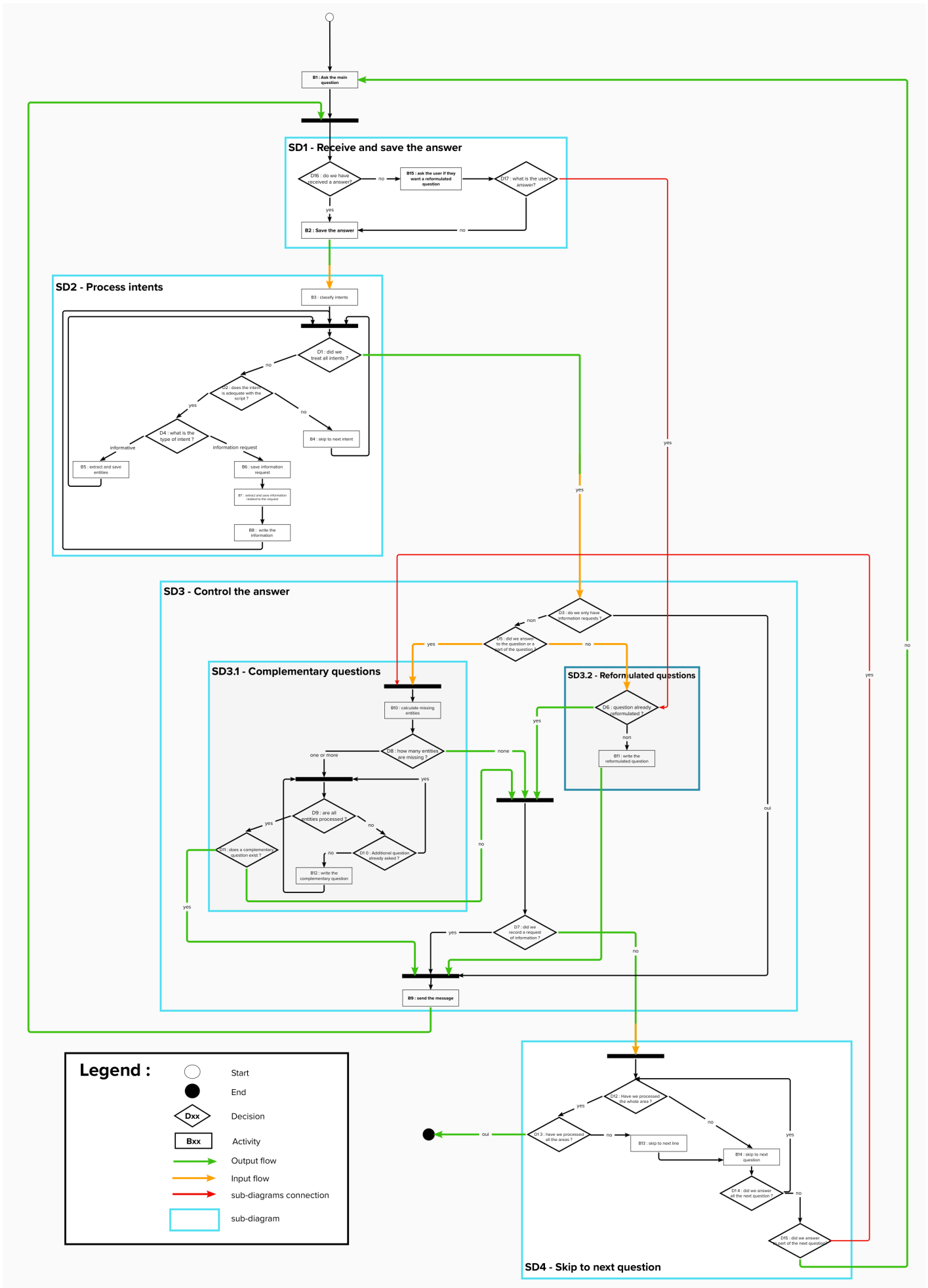


Fig. 11: Detailed process chatbot