Conversational Flow and Dialogue Management in a Social Robot using a Knowledge Graph
— Internship —

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Project: An engaging discussion robot for mental health preservation (DiscoBot)
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Location:

- IMT Atlantique (Brest campus, Technopôle Brest-Iroise), Plouzané, France
- ENIB (Technopôle Brest-Iroise), Plouzané, France

Time period: from February/March 2026, with a duration of 4–6 months (flexible)
Gratification: approximately 600 euros per month

1 Context

The objective of the DiscoBot project is to preserve the mental health of socially isolated persons (most of all their cognitive abilities), by offering an engaging interaction with a conversational agent [3] embodied in a social Navel robot. To provide an engaging dialogue, the robot will discuss about the person's biography [4]. At the same time, to avoid the format of an interrogation, the robot will be endowed with a personality and a backstory that it will be able to tell. A (partial) natural-language understanding pipeline has already been implemented using VOSK for speech recognition, spaCy for Natural Language Processing, and the Neo4J graph database (Community offline edition) with its Cypher query language for storing knowledge. This pipeline enables the humanoid robot Navel to understand spoken language and store extracted information in a structured, machine-usable form.

2 Intership Objectives

The internship will focus on one or several of the following topics.

2.1 Conversational Flow and Dialogue Management

The goal is to implement a dialogue manager capable of:

- generating appropriate comments for a given piece of information;
- generating clarification questions based on a piece of stored information;
- generating follow-up questions based on a piece of stored information;
- handling turn-taking between the user and the conversational agent;
- handling natural transitions between topics.

2.2 Natural Human–Robot Interaction

The goal is to implement a dialogue manager that can:

- modify answers according to the personality traits of the conversational agent;
- modulate answer length based on the context;

- modulate answer formality (formal, informal) based on context;
- exploit interruptions and overlaps in a dialogue (when a user starts speaking before his interlocutor has finished his phrase) to detect and manifest:
  - cooperation (manifested through supportive/enthusiastic comments) or competition (manifested as a struggle for dominance, or for control of the conversation) ;
  - familiarity between speakers, or respect, or conflict.
- recognize user's emotional tone, produce textual answers and vocal utterances with a given tone, and manage the tone of the dialogue in general (by deciding which tone to use for the next utterance).

2.3 Synchronization of Dialogue with Facial Expressions and Body Movements

The goal is to synchronize robot's facial expressions, head movements, and arm gestures with the conversational content [1, 2] .

- map semantic or emotional content extracted by the Natural Language Understanding module (e.g., sentiment or intent) to facial expressions and head movements (smiles, nods, eyebrow movements).
- coordinate animations with the dialogue manager (e.g., nod while listening, blink patterns, expressive changes when responding).

These behaviours will be implemented through the Navel robot's Python interface for controlling motors, facial actuators, and LEDs.

References

[1] Zahid Akhtar, Kamran Siddique, Ajita Rattani, Syaheerah Lebai Lutfi, and Tiago H. Falk. "Why is Multimedia Quality of Experience Assessment a Challenging Problem?" In: *IEEE Access* 7 (2019), pp. 117897–117915. DOI: 10.1109/ACCESS.2019.2936470.

[2] Yugo Hayashi. "Modeling synchronization for detecting collaborative learning process using a pedagogical conversational agent: Investigation using recurrent indicators of gaze, language, and facial expression". In: *International Journal of Artificial Intelligence in Education* 34.3 (2024), pp. 1206–1247.

[3] Anna Liednikova. "Human-Machine Dialogue in the Medical Field. Using Dialog to Collect Important Patient Information". PhD thesis. Université de Lorraine, 2022.

[4] Heikki Rantala, Eero Hyvönen, and Petri Leskinen. "Finding and explaining relations in a biographical knowledge graph based on life events: Case BiographySampo". In: *Extended Semantic Web Conference*. CEUR-WS. org. 2023.

3 How to apply?

Please submit your application containing CV, academic transcripts, and motivation letter to:
`mihai[dot]andries[at]imt-atlantique[dot]fr` before 15 February 2026.