Conversational Recommender System for Audio Listening Device Based on Ontology

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***Abstract*— Audio devices especially headphones, headsets, and earphones, are often used for daily activities. With the rapid development in the market, we can now choose a variety of specifications, shapes, and models that we may not know. To help us choose the right item, we usually use recommender systems such as conversational recommender systems (CRS). However, most CRS systems use the technical specifications of products as a reference to recommend items to users. Users who do not understand technical specifications and do not follow the development of the items find it difficult to choose an item that suits their needs. To overcome this problem is to directly ask about the functionality needs of users so that the recommender system can recommend items appropriately. This research evaluates an ontology-based CRS system as the main structure of the system, then embeds knowledge in it to facilitate conversational interaction with users, provide product recommendations, and explain the results of recommended items in the domain of audio listening devices. System evaluation is based on system performance and user satisfaction, accuracy for system performance gets a value of around 86.57% and gets positive results for user satisfaction. These results show that the system successfully provides recommendations that suit the users.**

Keywords*— *audio listening device recommender system, ontology-based recommender system, conversational recommender system, recommender system, knowledge-based recommender system.

I. INTRODUCTION

The rapid development of technology has brought us a wide selection of audio devices, such as headphones, headsets, and earphones that have unknowingly become part of our daily lives today. We use these audio devices for a variety of purposes, from listening to music to relax, work, exercise, to attending meetings and online classes that are often done these days[1]–[3]. The popularity of these audio listening devices will continue in the coming years [4]. There is a wide variety of audio listening devices available in the market, each with unique features that meet ergonomic design standards. Irrespective of the brand or sound quality, these audio devices can be categorized into four basic types: 1) Earbuds - small and lightweight, they fit reasonably well in the ear but do not isolate sound effectively, 2) In-ears - equipped with small rubber bands of different sizes, they are directly fitted into the ear canal and provide better sound isolation and no leakage, 3) On-ear - larger in size, they fit into the ear but do not cover it entirely, and 4) Over-ear - these completely cover the ear and provide the best sound experience while isolating the sound [3]. With so many options available, it can be challenging for users to select an audio device that meets their needs and preferences.

The use of a recommender system will greatly help users get quality recommendations that are easy to access [5]. In its development comes Conversational Recommender System (CRS) to provide more effective item recommendation services based on their needs where the mechanism is like having a conversation with the user [6], the primary goal of CRS is to identify and suggest the most fitting information to users through text or spoken interactions, facilitating more efficient communication using natural language dialogues. [7]. The system will guide the user using interactive dialogs, then the system will usually ask questions about functional needs rather than about technical matters, by utilizing the available domain knowledge, the system provides various types of interactions, such as providing guidance and further explanations or providing assistance mechanisms to help users when facing situations when no product meets all user needs[8], [9].

II. RELATED WORK

The Conversational Recommender System has undergone rapid development, with several approaches now available for use. One of the main reasons for this is the breadth of domains that can benefit from this technology. Numerous studies have been conducted on CRS, each using various methods to highlight its adaptability in today's world.

There are two approaches to obtaining information within CRS based on Baizal et al. [10], [11] specifically Navigation by Proposing (NBP) and Navigation by Asking (NBA). With the NBA approach system will ask several questions about user needs, while in NBP the system will show several products to users based on the feedback obtained. The research paper also talks about a model of ontology and an algorithm that can create interaction between the system and the user. The system acts as a salesperson and recommends products to the user. Callebert et al. [12] also built a CRS called Cora to generate personalized food recipes for users, in the study they used rapport-building strategies such as Small Talk as an introductory phase, Self-Disclosures to reveal personal information, Feedback and Acknowledgements to show that Cora understands what the user is asking for, and Personal opinions as Explanations to justify the opinion of the system's recommendation results. This research also carries two types of modes for conversation between users and the system to facilitate research, namely Cora-Mode and User-Mode. Narducci et al. [13] also try to compare different interaction methods within the music domain, like natural language, button-based interfaces, and a combination of both. They also implemented most of the necessary features expected in a recommender system, including acquiring preferences, exploring profiles, utilizing critique strategies, and offering explanations. This research aims to utilize the CRS framework and ontology, then based on the framework will be developed in the audio device domain [11], because each device has different types, models, and sound advantages that may be less understood by