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An E-commerce Chatbot with Product Recommendation System

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A thesis submitted for the degree of Master of Science in Artificial Intelligence

At

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Abstract:

5 This thesis presents the design and implementation of a **machine learning-based chatbot integrated with a product recommendation system**. With the rapid growth of e-commerce, there is an increasing need for intelligent systems that can manage customer interactions and provide personalized shopping experiences.

12 The proposed system uses **natural language processing (NLP) techniques** to understand user queries and respond in a context-aware manner. In addition, a recommendation module is included to analyze user behavior and suggest relevant products, improving user engagement and satisfaction.

The system consists of several components, including a user interface, chatbot engine, NLP processing unit, product database, and recommendation system. The dataset used in this study was obtained from **Kaggle** and was preprocessed to ensure consistency and positive results.

5 The results show that the system performs well in **intent recognition** and provides useful product recommendations.

This thesis contributes to the field of **e-commerce systems** by offering an automated and scalable solution that supports personalization

List of Publications

9 This **thesis** does not have any publications at the time of submission.

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Chapter 1: Introduction

1.1 Overview

E-commerce platforms have become an essential part of modern business operations. However, traditional customer support methods are often difficult to scale and may reduce user satisfaction. **Artificial intelligence techniques**, particularly natural language processing, allow chatbots and other automated agents to better understand user queries and respond effectively. In addition, recommendation systems can improve the user experience by suggesting relevant products based on user behavior and preferences.

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1.2 Problem Statement

Despite the continuous development of **e-commerce platforms**, response time and the quality of customer support remain key challenges. Traditional **chatbots** are often limited in their capabilities, as they rely on predefined rules and struggle to understand more complex user inquiries and many existing systems are not able to provide personalized recommendations that match individual customer needs and preferences, which reduces the overall effectiveness of these platforms.

1.3 Thesis Objectives

This project focuses on building an **AI-based chatbot integrated with a recommendation system**. The idea is to combine both technologies using machine learning to improve response accuracy, reduce customer waiting time, and increase user satisfaction.

The system is also designed to provide quick answers to user questions and suggest relevant products by understanding user preferences and behavior.

1.4 Thesis Contribution

This project combines a chatbot with a recommendation system in a single application. It shows how natural language processing (NLP) can be applied in real e-commerce systems. The contribution of this work is improving automation while also supporting more personalized user experiences.

1.5 Dataset Used

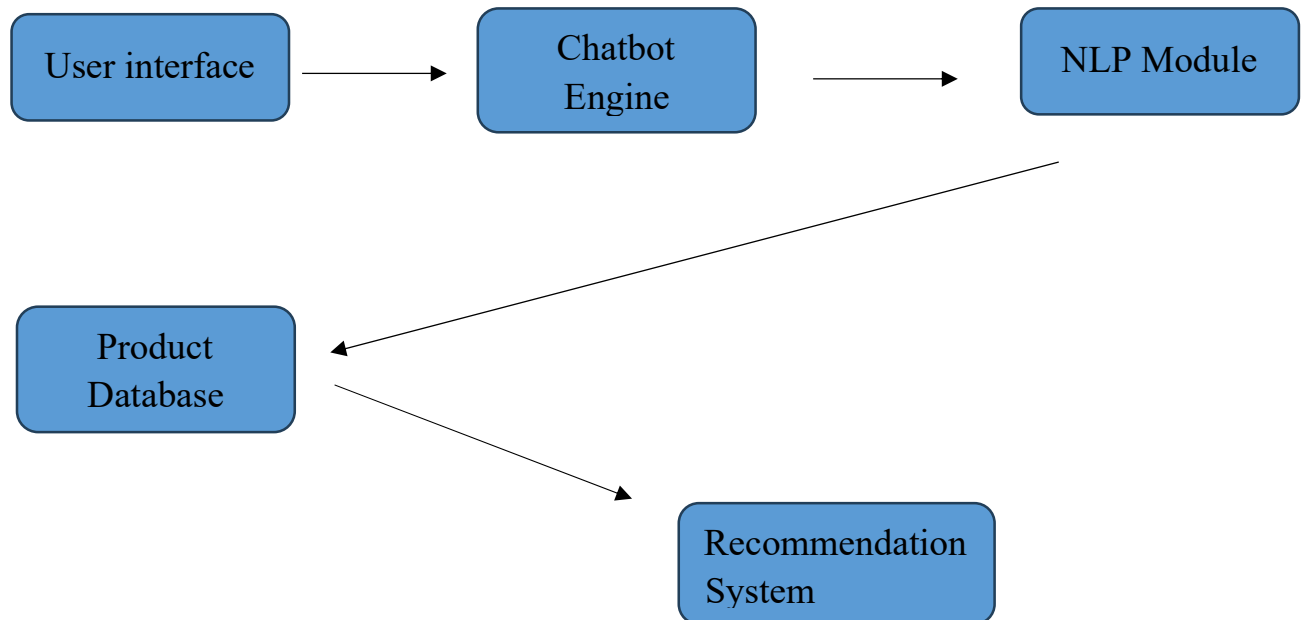
For this project, we used a dataset from Kaggle that includes product information and simulated customer queries. Before starting the analysis, the data was cleaned by fixing inconsistencies, handling missing values, and preparing it in a format suitable for machine learning models. This preparation improved the overall performance of the system and helped ensure more reliable results.

1.6 Proposed Framework

The proposed system is made up of several parts, including a user interface, chatbot engine, NLP module, product database, and recommendation system. When a user sends a message, the system first processes it using natural language processing (NLP) and intent detection to understand what the user wants. Based on this, it gathers relevant information, generates suitable suggestions, and then sends the final response back to the user.

Figure 1: System Architecture Diagram

This figure shows the pipeline of the **chatbot system combined with the recommendation module**.



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Chapter 2: Background and Related Work

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This chapter gives a short overview of the technologies used in this project. It covers areas such as artificial intelligence, machine learning, and natural language processing (NLP), which all work together to build smart systems. **Artificial intelligence** helps systems make decisions and handle tasks automatically, while machine learning allows them to learn from data and improve over time. **Natural language processing (NLP)** is used so that machines can understand human language and respond correctly. These technologies are commonly used in **chatbots** to handle user conversations and in recommendation systems to suggest products based on user preferences.

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Related Work Analysis:

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Several studies have contributed to **natural language processing, recommender systems, and conversational AI**. Devlin et al. (2019) introduced BERT, which improved many NLP tasks, while Vaswani et al. (2017) proposed the Transformer model that is widely used in modern language processing. **In recommender systems**, Ricci et al. (2011) explained the basic concepts, and Zhang et al. (2019) reviewed the use of deep learning to improve recommendations. Burke (2002) introduced hybrid recommender systems, and Koren et al. (2009) worked on collaborative filtering methods.

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For chatbots and conversational systems, Serban et al. (2016) studied neural dialogue models, while Chen et al. (2017) and Li et al. (2018) improved chatbot interaction and context understanding using deep learning. Sun et al. (2019) applied BERT in conversational AI, and Huang et al. (2020) explored conversational recommendation systems. Zhou et al. (2020) proposed frameworks that combine chatbots with recommendation systems, and Wu et al. (2020)

reviewed deep learning-based recommender systems. Shani and Gunawardana (2011) and Jannach et al. (2016) focused on user behavior and evaluation in recommender systems.

Chapter 3: Proposed Approach

The proposed system combines an **NLP-based chatbot** with a **recommendation engine** to manage user interactions. When a user sends a message, the system first processes the text using **tokenization and intent recognition** to understand the input and identify what the user needs. This helps determine the purpose of the query and guides the next steps. Based on the detected intent, relevant data is retrieved from the database. At the same time, the recommendation module generates product suggestions depending on the context of the query. The system then produces a final response and returns it to the user.

System Diagram:

User → Chatbot → NLP → Intent → DB → Recommendation → Response

Chapter 4: Experimental Results and Discussion

The system went through testing with random data and mock queries from the users.

The bot really did well in correctly figuring what users wanted.

The recommendation engine came up with spot-on suggestions about the products.

The combined solution has positively impacted user experience and efficiency.

Discussion

By integrating chatbot and recommendation system, the overall system gets more efficient.

This shows that the product can be scaled and implemented in the real world effectively.

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The use of more advanced deep learning models can bring even greater refinements.

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Chapter 5: Conclusion and Future Work

The proposed system is an effective integration of chatbot and recommendation functionalities.

Besides, the system helps with improving customer interaction and makes operation efficient.

Possible future development goes in the line of adding voice interaction and real-time learning capabilities.

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