Software Factory for Developing Chat-bots in Smart Tourism Mobile Application

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*Abstract*— This study explores the potential of a software factory approach for developing chatbots in smart tourism mobile applications. The paper highlights the limitations of current chatbot development processes and the challenges of tailoring generic chatbots to the specific needs of the tourism sector. Model-Driven Engineering (MDE) and Domain-Specific Languages (DSLs) are presented as solutions to streamline chatbot development and improve customization for smart tourism applications. The integration of advanced AI technologies and user-centric design principles is emphasized to enhancing the user experience. The study might have answered questions about chatbots' flexibility and scalability in various tourism contexts. The platform-independent and platform-dependent models created may provide a framework that is adaptable to varying smart tourist locations and allows for the scalability of chatbot features.

Keywords— Chatbot development, Smart tourism, Mobile application, Model-Driven Engineering, Software factory, Domain-Specific Language

# Introduction

The considerable tourism business development has been in recent decades, characterized by the increasing connectivity of tourists and their growing demands [1]. Travelers in this day do not just want to create unforgettable memories during their trip, but also expect personalised service, attentive service and unprecedented comfort [2]. Mobile applications have risen to prominence within the industry, serving as pivotal digital mediators connecting tourists with service providers.

There is a significant shifted in the field of tourism sector towards mobile applications, fundamentally altering the process of making travel arrangements, encompassing flight bookings, accommodation searches, and exploration of local attractions [3]. Recent advancements in Artificial Intelligence (AI) and Natural Language Processing (NLP) have had a substantial influence on this change, resulting in these applications becoming interactive travel assistance capable of understanding and resolving the specific needs of individual travelers.The integration of smart tourism and those two aspects lays the foundation for an innovative era of personalized and immersive travel experiences [4]

The integration of cutting-edge technology within the destination of the tourist has create bigger influence to the conceptualization of Smart Tourism Destinations (STDs), marking a paradigm shift towards digitally enhanced and interconnected travel experiences [5]. This idea illustration in several locations make the smartphone application used organized in six primary components by Buhalis et al. The facilities, activities, attractions, packages, available, accessibility also the extra services. These components underline how important mobile apps in driving smart tourism and personalized experiences [6]

Ensuring user-friendliness stands out as a primary hurdle for mobile apps [6]Travelers crave smooth and intuitive experiences, making chatbots invaluable. Embedded more extensively within these applications, chatbots provide a conversational interface facilitating seamless interaction for tourists, enabling them to ask questions and receive prompt responses, thus enhancing their experience while capitalizing on the convenience afforded by mobile platforms [7]

The evolution of chatbots has garnered considerable attention in software development, with tech giants like, Amazon, Microsoft, Google and IBM investing in their own solutions including Amazon Lex, Dialogflow, Bot Framework and Watson. Despite the substantial presence of chatbot providers in the market, as indicated by Gartner's estimation of around 1000 to 1500 platforms, the majority of these offerings cater to general applications without tailored adaptations for the tourism sector [8]

The tourism industry has experienced a significant evolution propelled by the growing connectivity among tourists and their changing preferences for personalized and adaptive experiences. Mobile applications have emerged as pivotal tools in this transformation, facilitated by the evolving of Natural Language Processing (NLP) and Artificial Intelligence (AI). The concept of Smart Tourism Destinations (STDs) has emerged, highlighting the integration of intelligent technology to enhance tourist experiences.

In the tourism sector, ensuring user-friendly interfaces remains a critical challenge for mobile applications, with chatbots serving a pivotal role in delivering seamless interactions and immediate responses. However, despite the availability of various platforms and frameworks for chatbot development, it remains a complex task requiring expertise in both software development and AI.

Innovations in chatbot development have attracted attention from major tech companies, but the market still lacks tailored solutions for the tourism sector. Overcoming these challenges necessitates investment in human resources and the adoption of modeling languages conducive to chatbot development. Ultimately, the integration of those aspects sets the stage for a transformative phase in travel marked by personalized and immersive experiences.

# Related works

MDE (Model-Driven Engineering) refers to an approach of distinctive development in term of software, prioritizing the crafting and utilization of domain models, which function as abstract representations encompassing all elements relevant to a specific problem [9] These models don't adhere to computational or algorithmic principles; instead, they serve as abstract representations of the information and operations guiding a particular application. MDE is a branch of round-trip engineering, a software design methodology [10]

MDE endeavors to boost productivity by developing system compatibility, simplifying the design process with recurring design patterns, and facilitating communication among individuals and teams in system development through terminology standardization [11]. The most well-liked MDE initiative is QVT, which is used in various XMI, CWM, CORBA, and Unified Modeling Language (UML) projects. The Object Management Group is in charge of the MDA (Model Driven Architecture) methodology. Another well-liked instrument for putting MDE principles into practice is the Eclipse Modeling Framework (EMF) [12]

A model-driven approach to automating the synthesis of recommend-er systems for modeling languages is the automated method where all the components of the RS are configured using a domain-specific language called Droid [13]. Droid is a DSL that makes it possible to automate the synthesis, evaluation, and deployment of recommend-er systems for modeling languages[14]. This approach generates the recommend-er system from the domain model and assesses it using common metrics. An interactive message with one button for each suggested item provides the recommendations [15]

Three steps make up the model-driven conceptual framework for developing mobile recommend-er systems of geographic sites of interest [16]. These phases aid developers in defining the structural, behavioral, and navigational aspects of a recommendation system at a high degree of abstraction [17]. The framework's goal is to give developers of mobile recommend-er systems a methodical way to create systems that can efficiently recommend items of interest to users based on their location and preferences [18]

The foundational concepts of social networks that can be utilized for recommendations are integrated with domain-independent collaborative filtering concepts in the model-driven development framework for social network-based recommend-er systems [19]. With the help of this framework, programmers can build recommend-er systems that can better utilize social network data to augment recommendations and combine domain-independent collaborative filtering techniques to increase recommendation accuracy (Masrom et al., 2021).

# METHOD

The study of streamlining software development processes through the use of models and transformations is known as "Model-Driven Engineering'' (MDE) [21]. Model-driven engineering (MDE) is a methodical software development strategy that prioritizes the usage of models as the main artifacts. MDE is utilized to provide insights on efficient modeling tools and methodologies in a variety of disciplines, including chatbot development (David et al., 2021).

In the framework of MDE, models are used to describe all facets of a software system, such as its behavior, navigation, and structure..These models are subsequently translated into code via model-to-model transformations (MMTs) or other automated methods. MDE has changed significantly over time due to advances in automation, abstraction, and the use of domain-specific languages (DSLs) for code generation. The rapid growth of the tourism industry in recent decades has been marked by travelers' expanding needs and increased connectedness. Research on model-driven development (MDE) covers a broad spectrum of subjects, such as creating new modeling languages, creating MDE tools, and using MDE in many fields . Models are essential to the success of modern software engineering techniques in sectors where the discipline has been applied, such as embedded systems, automotive, business process engineering, and railway systems .

Using conversational models to describe a chatbot's behavior is one way that MDE is applied in the chatbot generation process. By leveraging these models to generate code for the chatbot's natural language processing (NLP) features, developers may focus on the functionality rather than the underlying programming.

A diagram of a software development process

Description automatically generated with medium confidence

Numerous chatbot building frameworks, like IBM Watson, Dialogflow, and Rasa, have been the focus of in-depth investigation. The comparisons and insights these studies have provided regarding the benefits and drawbacks of the conversational agent building tools on the market now are highly valuable.Investigating the usage of Artificial Intelligence (AI) technology in the tourism industry may yield creative ways to improve user experiences and customize services. Extensive research on chatbot user interface design, particularly in relation to mobile applications and smart tourism, can offer valuable insights for developing user interfaces that are both clear and captivating, ultimately improving the user experience. The "software factory concept" approach to chatbot development automates the procedure, enabling faster chatbot generation without sacrificing consistency or quality. It focuses on creating artifacts, such Domain-Specific Languages (DSLs), patterns, and tools, at the stages of analysis, design, and implementation. By offering defined procedures, best practices, and resources for building and overseeing chat bots, these artifacts are intended to facilitate the development of chat bots. Businesses may ensure that their chatbots are of the highest caliber and satisfy particular business requirements by streamlining their chatbot development process, cutting down on development time, and utilizing a software factory.

A diagram of a chatbot model

Description automatically generated

# RESULTS

The creation of chatbots for smart tourist applications may be more efficient when model-driven methodology, software factories, and DSLs are used. The development process could be streamlined using automation and consistency to create chatbots more quickly and with less effort. The study may have improved chatbot customization and customizing to match the unique needs and difficulties of the smart tourism domain by utilizing DSLs and high-level abstractions. As a result, chatbots may become more adept at offering travelers individualized and context-aware services. The integration of advanced AI technologies and execution engines, along with a focus on user-centric design, may have contributed to improving the overall user experience of chatbots in smart tourism mobile applications. Enhanced conversational capabilities and intuitive interactions could lead to higher user satisfaction. The study might have answered questions about chatbots' flexibility and scalability in various tourism contexts. The platform-independent and platform-dependent models created may provide a framework that is adaptable to varying smart tourist locations and allows for the scalability of chatbot features. Potential research directions include integrating additional AI technologies, assessing chatbot performance in real-world tourism scenarios, addressing sustainability and cost-effectiveness issues, and improving chatbot deployment security and interoperability in smart tourism applications.

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