**<Hal 2001>**

**Special Course in Software Engineering Project Report**

***Version <1.0>***

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**(Group #)**

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# Introduction

## Purpose

The HAL Chatbot project demonstrates the entire process in a structure based on analysing, requirements extracting, designing, developing, and testing. This report considers the ones that are fans of the movie 2001: A Space Odyssey as the target audiences, from which they can fully understand the crucial points of what the chatbot is capable of and how does it doing it.

## Overview

The customer experience in the media and entertainment industry can be measured in two main ways called primary services and additional services.

The primary service is the event, show or display itself that the customer comes to.

Additional services support the primary service, such as the pre and post ticketing experience, readily available information, staff assistance, etc. HubSpot Research reports that 90% of customers consider immediate response time to be very or extremely important in customer service. For sales and marketing inquiries, that percentage drops slightly - to 82 percent. According to Zendesk's Customer Experience Trends report, about half of customers consider 24/7 support to be an important part of good customer service.

And with conversational AI chatbot technology, you can get.

1. Robotic process automation for common tasks

2. 24/7 customer service automation

3. reduced customer service queue times

4. secure self-service options for customers

HAL 2001 is a fan site developed and maintained by a group of fans of the movie 2001: A Space Odyssey. The Hal chatbot should engage users on trivial topics and provide responses that HAL from the movie/novel would have provided. These responses are likely to be very sharp, straightforward, smart, but a little dark to a regular human being. In addition, the bot should also help address customer grievances related to the merchandise they purchase from the website.

The industrial domain for Hal is entertainment, and in generalchatbots are are designed and developed for a specific domain. These domains are narrow and applicable to to the concern of the organization they serve. Hence chatbots are custom and purpose built as an extension of the organization's operation, usually to allow customers to self-service.

## Definition, Acronyms, and Abbreviations(FOR LATER)

*Provide definitions for all terms, acronyms, and abbreviations required to properly interpret how they are used in this document.*

* AI （Artificial Intelligence）：
* Slot
* Intent
* Entity
* 。。。

**\*\* Everyone or anyone from the group can take responsibility of this section. Ideally, everyone should contribute, at least in proof reading.**

# Background (FOR LATER)

*This section covers the background information necessary for a reader to understand the report to follow. Essentially, this section covers why your chatbot should matter to the people of the industry that it is relevant to, what benefits can they get from the said chatbot, and the concepts that underlie the implementation of the chatbot, which can also help a layman follow this document without much difficulty. All the necessary background information should be conveyed in no more than* ***two to three pages****.*

## Chatbot Background

*Discuss the domain to which your chatbot falls in, to motivate the rationale and necessity of your chatbot . Use scientific literature to justify the existence of your own chatbot, especially in the context of the industry domain you are targeting*

## Salient Concepts

*Next, describe* *the following salient concepts that play a major role in the functioning of your chatbot. Besides the concepts listed below, you are encouraged to include other concepts that are relevant to your chatbot:*

* *Natural Language Processing (NLP)*
* *Natural Language Understanding (NLU)*
* *Artificial Intelligence (AI)*
* *Deep Learning*
* *IBM Watson Assistant / RASA Framework*

## Report summary

*Summarize the different sections to follow, by describing what the readers can expect from each section going forward*

**\*\* Everyone or anyone from the group can take responsibility of this section. Ideally, everyone should contribute, at least in proof reading.**

# Requirements Specifications and Analysis

## Problem Statement

1. What can be done to resolve the issue when a customer becomes upset and agitated?

2. Is there a way or means for the customer to connect to a human service?

3. Is there a certain automatic help function when the customer makes an inquiry?

4. When the customer wants to make a complaint, how to resolve it?

5. if the customer feedback is relatively simple similar to the problem of querying the courier number, how to give a quick answer?

6. if the customer encounters a problem is more difficult, how to further solve the problem?

7. how to solve the customer consultation time if it is not within the time of manual customer service?

8. Can all the questions asked by customers be reasonably solved?

## Proposed Solution

1. Chatbots generally output relatively interesting information or use a HAL-like response mechanism, similar to introducing information about websites and topics such as weather, jokes, etc. that can lighten and enhance the user's mood.

2. chatbots can generally answer all of the user's questions, and when the user's questions are more complex or the customer no longer wants to communicate with the chatbot, the chatbot can connect to a human supervisor who will never take over the next step.

3. The chatbot will respond to the user's needs and will make alternatives for the user to choose from. The chatbot can be helpful and proactive in solving any problem the customer has.

4. When a user wants to file a complaint, the chatbot will reassure the customer and connect to a human supervisor to respond to the user's complaint and display the human supervisor's name for tracking.

5. The chatbot can help the user with simple questions such as delivery numbers, links and addresses, and will automatically provide links to help the customer solve the problem.

6. If the user encounters a problem that the chatbot cannot solve, the chatbot will provide feedback to the human supervisor and follow up with him/her. Even if the customer is not willing to accept the alternative solution provided by the chatbot, he/she can follow up by asking for the user's phone number and having the human supervisor make a phone call.

7. The chatbot is online 24 hours a day to help users solve problems and communicate with them, assuming the human supervisor is not online.

The chatbot is online 24 hours a day, and if the user is not satisfied with the solution provided, the chatbot can contact the human supervisor for the next step.

## Information gathering \*\*（没填好）

*Summarize the process of preparing, conducting, and processing the interview(s) held to elicit, confirm, and approve the user requirements. List the individual requirements, as user stories.*

Questions.

1. When communicating with customers, does the chatbot make the communication easy?

2. How does the chatbot solve the user's problem?

3. When a chatbot is unable to solve a problem, what method is used to continue the problem?

4. Can chatbots be hosted in the cloud?

1) Yes. --Are there terms and conditions that dictate where chatbots can be located and integrated?

2) No. -- How do you implement such a full-featured intelligent chatbot?

5. Is there a provision for the tone and language used by the chatbot?

Answer.

1. Yes. Chatbots can be very sharp, direct, and clever, but a bit dark for the average person. The chatbot will provide funny, "hal-like" responses to user input on jokes, other light-hearted topics, and even philosophy.

2. The bot is also supposed to help resolve customer dissatisfaction with the items they purchase from the site. Merchandise dissatisfaction is mainly related to order delays, damaged packages, incorrect packages, etc. Chatbots resolve customer grievances in a typical "HAL" fashion.

3. If any problems are encountered in processing any of the above user requests, the chatbot should be able to provide an alternative solution to the customer's query. If the chatbot connects to a human supervisor and chats with them, the chatbot should indicate that it is connected to a human supervisor and display the supervisor's name. If the chatbot asks the user to provide details of the query in an email, the chatbot should provide the user with the email id to which they can send the query. If the chatbot asks the user if they would like to call the executive immediately, the chatbot should first ask for the user's phone number and then ask permission for one of the executives to call the number.

4. Right. The company will integrate the chatbot into its main application, so the necessary provisions should be made to enable this integration in the future. This requirement is non-negotiable.

5. The chatbot should have a direct and decent tone, using formal language. However, it is always objective, even if this means offending someone.

## Functional Requirements

1. Ability to respond to user questions 24 hours a day

2. the ability to have chatbots integrated into the application

3. the ability to send emails to users

4. send the user's phone number or provide a link to the user

5. the ability to provide a chat tone similar to HML

6. the ability to send timely information about movies, scripts, and actors for HAL 2001

7. allow users to participate in trivial topics

## Non-functional Requirements

1. memory footprint, without taking up too much memory

2. precise language of the chatbot, with the corresponding HAL style, even if to some extent offensive

3. the corresponding time, when the user asks a question, to be able to give a timely answer

4. the number of users, to be able to correspond to the number of users for certain statistics, statistical planning chart

## User classes and characteristics

Most of the people who visit the website are fans of HAL 2001, so we can classify them according to the frequency of using this movie. Those who have primary knowledge or want to know about the movie HAL 2001, and who generally do not use it very often, are classified as user category A.

Characteristics of user category **A.**

1. want to know about the movie HAL, have some interest in the plot of the movie and the comprehensive information of the actors, but have not yet made more understanding.

2. have watched the movie HAL 2001, have a relatively vague understanding of the specific information of the movie, and want to explore more information. 3.

3. did not have a clear memory of the lines in the movie and was not able to directly accept or respond to the chatting atmosphere guided by the chatbot's lines.

4. not very receptive to the trivial discussions about the movie on the website.

Users who like the movie, visit the site at certain times, visit the site a certain number of times, and have some potential purchasing power for the products on the site are classified as User Category B.

Characteristics of user category **B**:

1. they want to know more about the plot of the movie, comprehensive information about the actors and actresses, as well as film footage and behind-the-scenes information, and want to get more information about the movie HAL 2001.

2. people who have a desire to buy products on the website, who can generate some spending power on the website, and who are interested in the peripheral products of the movie.

3. people who have a certain degree of knowledge and memory of the classic lines from the movie/novel, who can respond to the specific lines sent by the chatbot, and who understand and adapt to the chatting atmosphere of the chatbot on the website.

4. have a willingness to participate in and speak up on trivial discussions about the movie on the website.

People who love the movie, visit the site regularly, and buy products on the site are classified as User Category **C**.

Characteristics of User Category C:

1. they know the plot of the movie, comprehensive information about the actors and actresses, as well as the movie highlights and behind the scenes.

2. they buy products on the website frequently and love the peripheral products of the movie/novel

3. have a good understanding of the lines in the movie/novel, and like and enjoy the chatting atmosphere provided by the chatbot with HAL's specific environment.

4. are very involved in the trivial discussions on the site about the movie, and often speak in the topics.

According to the above classification, it can be found that the user A chatbot only serves as a relative introduction to the movie details and provides some links to the users of this category to facilitate their inquiries about the movie/novel, while the chatbot atmosphere with HAL style is not used very often and does not make certain purchases for the products offered on the website. Therefore, I think that chatbots with HAL chatting atmosphere will make this type of users uncomfortable because of the dark atmosphere in the plot, so I think chatbots should use an introductory and enthusiastic tone for this type of users. User B can accept and have some understanding of the lines, and can participate in trivial topic discussions. This type of user is the one who should have a HAL tone, and the chatbot should guide them for carrying out topic discussions, and push some goods in time, they have some interest in the goods, and are potential buying customers. User C should be the most important group of customers, they enjoy the HAL chatting atmosphere and can actively answer the chatbot's questions, this group of people has a strong interest in the products, in pre-sales and after-sales issues, the chatbot should produce a satisfactory response mechanism for these customers. For this type of users, the chatbot should use a HAL chat atmosphere and push new products in a timely manner.

## Constraints

Describe any items or issues that would limit the options available to chatbot developers. These may include: company or regulatory policies; hardware limitations (time requirements, memory requirements); interfaces with other applications; specific technologies, tools, and databases to be used; parallel operations; language requirements; communication protocols; security considerations; design conventions or programming standards (e.g., if the customer's organization will be responsible for maintaining the delivered software.

Chatbots with HAL style cost more

Because of the need to carry the unique linguistic atmosphere of the HAL 2001 movie/novel in the HAL website, even chatbots based on artificial intelligence and machine learning can be difficult to implement, even if they seem to be the next stage of evolution. Algorithms and frameworks can be sourced from service providers, but aligning them with the features in the entire HAL 2001 movie/novel requires providing the chatbot with relevant information about the entire movie in a predefined format, a massive undertaking, and the task of fine-tuning the AI chatbot for the website to take advantage of all its offerings is a task for experts, which requires significant investment and time.

Limited database and limited responsiveness to customers

In that since most Bots are either support chatbots or service-based chatbots, the number of responses to end users is limited to the scope of their messages. Similar to the three categories of users ABC of HAL 2001, since menu-based chatbots are limited to their queries and try to classify users, but they cannot deviate from other domains or accumulate information from current external scenarios into their responses. As a result, it is limited to the majority of users and is not fully accurate in categorizing customers accordingly

Machine Learning Security Vulnerabilities in Chatbots, Vulnerable to Attacks

Chatbots are particularly vulnerable to machine learning attacks, and because of the different classifications of customers in the HAL2001 website, chatbots often interact with each other as users, and these interactions are often completely unsupervised. Data poisoning is a machine learning attack in which hackers contaminate the training data of a machine learning model. They do this by injecting adversarial inputs that are intentionally altered data samples with the aim of inducing the system to produce incorrect outputs. Systems like customer service chatbots that are continuously trained with user input data are particularly vulnerable to such attacks. Most modern chatbots can operate automatically and answer customer queries without human intervention. Typically, the conversation between the chatbot and the user is never monitored unless the query is escalated to a human. This lack of oversight makes chatbots a prime target for hackers to exploit.

Language Complexity in HAL 2001

Modern conversational interface applications rely heavily on advances in artificial intelligence and the proliferation of connected devices to provide users with shortcuts to perform simple tasks, such as getting answers to simple questions (e.g., who is the female star of HAL 2001) or completing a quick task (e.g., alerting the user that a package of purchased goods will arrive the next day), among other simple tasks. But as with software, language is based on a set of rules that evolve and develop over time. But speaking humans, unlike computers, are not constrained by these rules and are free to form words and sentences as a way to convey a message. Similar to regional dialects aside, what is needed for the HAL 2001 website is the unique language approach of the movie/novel, which traditionally would make it more difficult for a computer to understand a similar discourse. While machine learning has improved the computer's ability to recognize language, we have not yet developed artificial intelligence to the point where it can keep pace with the rapid evolution of language and understand each particular way of speaking at the right time.

## Assumption and Dependencies

Assumptions.

1. the chatbot in this project requires a specific language environment for HAL 2001 movies/novels, for which certain development conditions are required by the third party developing the chatbot. Assuming that no specific language environment is constituted, then the language environment that is wanted to be developed cannot be formed. It will cause some loss to the user's experience.

2. Whether the chatbots in HAL2001 website have consistent and rich personalities: for chatbots to be like credible people, they must be able to simulate the assumption of having unique personalities.

3. The environment in which the chatbot operates is also a hypothetical factor, and the pairing of different environments can affect many aspects of the chatbot.

Since AI chatbots rely on natural learning processing (NLP) to understand the semantics of incoming messages, unless a natural learning processing (NLP) parser is trained on the domain, the accuracy of identifying the intent and topic of interest will be unacceptable."

No chatbot implementation will understand domains. Developers need to train chatbots on custom domains to recognize scenarios

## Example use cases

图示

描述已自动生成

# Chatbot Design

*This section covers the design elements of your proposed chatbot. here. “design” refers to both the architecture of the chatbot and the dialogs that will dictate the conversation flow in every interaction with a user. In addition, the data design elements will also be covered, which refer to database and/or APIs used for data operations the chatbot is likely to handle. Do not take more than* ***six to seven pages*** *for this section.*

## System architecture

*Use scientific literature to learn about a typical chatbot architecture and adapt it to present your chatbot’s architecture. In brief, describe each component and their interactions.*

## Dialog Design

*Describe the overall logic behind the dialogs you have designed for your chatbot. Ensure to describe some of the major and tricky dialogs.*

*Next, describe the personality you have designed for the chatbot.*

*Provide adequate number of examples (at least three – four examples) of conversation between the bot and the user that illustrate your above logic and the personality traits.*

*A complete set of the designed dialogs must be provided as an* ***appendix****.*

## Data Design

*If your chatbot requires a database to retrieve and/or store information, then describe that database using a class diagram (*[*tutorial for class diagram*](https://www.visual-paradigm.com/support/documents/vpuserguide/94/2575/6362_drawinguseca.html)*) and describing each class and its functions.*

## System Operation

*Using either sequence diagram (*[*tutorial for sequence diagram*](https://www.visual-paradigm.com/support/documents/vpuserguide/94/2577/7025_drawingseque.html)*) or activity diagram (*[*tutorial for activity diagram*](https://www.visual-paradigm.com/tutorials/how-to-draw-activity-diagram-in-uml/)*), illustrate how your chatbot operates. Elaborate on the same examples that you have used earlier in this document for* ***use case views*** *and* ***dialog design****.*

**\*\* The *Designers* will take the lead on this section, followed by sufficient assistance from the *Requirement Engineers (REs)*. The rest are also encouraged to contribute, especially in proof reading.**

# Chatbot Development

*This section will describe the overall development efforts, including integration, undertaken for your chatbot. This section should not take more than* ***five to six pages.***

## Development Environment

*Depending on the approach used, describe your development environment, which includes both hardware and software specifications.*

*If using IBM Watson Assistant, describe all the necessary components, tools, technologies, APIs, etc., utilized for developing your chatbot. In addition, define the components of the IBM Watson Assistant, and discuss their use within the context of your chatbot.*

*If using RASA Framework, describe all the necessary components, tools, technologies, libraries, APIs, etc., utilized for developing your chatbot. Furthermore, describe the major methods, especially the ones you had add for implementing certain requirements, especially for external interactions like databases and APIs.*

## Integration

*Describe the integration approach adopted for your chatbot (desktop, live app, etc.). Provide screenshots of your chatbot integrated with your preferred channel.*

**\*\* The *Developers* will take the lead on this section, followed by sufficient assistance from the *Designers* and even *Requirement Engineers (REs),* if needed. The rest are also encouraged to contribute, especially in proof reading.**

# Testing

*This section describes both the internal testing and user testing carried out to test and evaluate the chatbot. Do not take more than* ***four to five pages*** *to write this section.*

## Internal Testing

*Describe the simulated conversational testing by listing some of the conversations (screenshots) you utilized for testing the chatbot. Pick examples that you have elaborated in the previous sections to discuss* ***user case views, dialog design,*** *and* ***system operation.***

*Next, discuss the outcomes of the testing; like the shortcomings identified and improvements recommended to the development team. Use the* ***seven-category checklist*** *already shared with you as a tool to test the chatbot.*

## User Testing

*Describe the simulated conversational testing by listing some of the conversations (screenshots) you utilized for testing the chatbot. Pick examples that showcase significant use cases of your chatbot within the context of your company and industry.*

*Next, discuss your evaluation of the final chatbot using the* ***seven-category checklist*** *already shared with you as a tool of evaluation.*

**\*\* Both the *Testers* and the *Stakeholders* will take the lead on their relevant parts in section, followed by sufficient assistance from the *Developers*. The rest are also encouraged to contribute, especially in proof reading.**

# Conclusion

*This section will summarize your entire document by talking about only the key takeaways. Should not be more than* ***one to two pages****.*

*Start by summarizing the need for your chatbot within the context of its dictated domain, problem statement, the solution conceived, the steps taken to develop that solution, the benefits of using your developed chatbot, the current shortcomings, and its assessment based on the user testing.*

*Next, also briefly discuss how your chatbot could be improved, outlining potential future work.*

**\*\* Everyone or anyone from the group can take responsibility of this section. Ideally, everyone should contribute, at least in proof reading.**

# References

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| --- | --- |
| [1] | V. R. B. G. Cldiera and D. Rombach, "The goal question metric approach," *Encyclopedia of software engineering,* vol. 2, pp. 528-532, 1994. |
| [2] | V. R. C. G. &. R. H. D. Basili, "Experience factory.," in *Encyclopedia of software engineering.*, 1994. |

Appendix A – List of User Stories

As a customer, I want the chatbot to provide interesting and "HAL-like" responses to relevant information entered by the user, information about the website such as weather, jokes or other light-hearted topics, or even philosophy.

As a customer, I want the chatbot to resolve customer grievances in a typically "HAL-like" manner.

I want to be able to resolve complaints about products such as delayed orders, damaged packaging, incorrect packages, etc.

As a customer, I would like the chatbot to be able to provide an alternative solution to the customer's query or even in some cases connect to a human supervisor and chat with them to resolve the issue, should the chatbot encounter any problems while handling any of the above user requests.

As a customer, I would expect that once the user chooses this alternative, the chatbot should indicate that it is connecting to the

human supervisor while also displaying the supervisor's name or asking the user to provide their detailed query in an email.

As a customer, I would expect that after choosing this alternative, the chatbot should provide the user with an email id and the chatbot could send their query to ask the user if they would like to speak with the executive over the phone immediately.

As a customer, I would like to see that in this alternative, the chatbot should first ask the user for their phone number and then ask permission for one of the human executives to call that number.

As a customer, I would like the chatbot to be hosted in the cloud, just like the company's main application

As a customer, I would like the company to integrate the chatbot into its main application, so the necessary terms should be done to make future integration possible, and this is a requirement that must be met.

As a customer, since the company expects customers from all walks of life, I would expect that the chatbot should have a simple, dignified tone and be able to use formal language. However, a chatbot will always be objective, even if it means to offend.

Appendix B – List of functional and non-functional requirements

***(As user stories)***

Appendix C – Dialogs

Appendix D – Git Repository

***(Include the procedure to set up the environment to run your chatbot. This is a common practice. Look at some git repositories to get an idea on what and how to write this part)***

Appendix E – Seven-category assessment (Internal Testing)

Appendix F – Seven-category assessment (User Testing)