Individual Reflective Report for R&D Project

Project Name: Chatbot Project

Student ID: 20108405

Student Name: Tianyang Li

Supervisor: Mr. Petteri Kaskenpalo

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Abstract

This is the reflective report on the chatbot R&D team project. The report briefly introduces the whole chatbot project, and uses critical thinking to evaluate the project from two aspects: the project achievements and the importance of the project to the organization. At the same time, it also makes a critical analysis on the relevant professional background knowledge, theory and research method involved in the project. In addition, the report also analyzes and evaluates the improvement of personal and professional growth ability and existing problems in the whole project. At the same time, combined with client feedback, the report evaluates the team collaboration, roles, the effectiveness of teamwork and points out the areas that need to be further improved in the future.

Acknowledgement

First of all I would like to express my sincere thanks to our team's client Mr. Goldy T Wijiaya and supervisor Mr. Petteri Kaskenpalo. Thanks to them for helping us throughout our whole R&D project. They gave our team a lot of technical and project management guidance during every team meeting and every communication. Without their helps, our team could not complete the development of the entire project efficiently and with high quality and quantity.

At the same time, I am also very grateful to every other member of our team: Shijie Ma, Hanpeng Jiang and Jiacheng Lv. Throughout the project, we helped each other, worked together when we encountered difficulties, actively participated in every team meeting and invested in the daily project development process. I am very grateful that they have given me great support and urged me to do better in organizing and researching. It is because of the hard work of everyone in the team that we can successfully complete the development of this chatbot project.

Finally, I would also like to sincerely thank all my family members and friends who love and care about me for their encouragement and help in my daily life.

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1. Introduction

chatbot are an important research direction in the fields of natural language processing and artificial intelligence. chatbot engage in conversations with humans by learning natural language. It can not only answer the questions raised by users, but also communicate with users in a human way, while reminding or arranging users to complete some tasks(Wang & Li, 2018).

Our project aims to develop a chatbot for Jaktent, a conference and virtual exhibition website. Jaktent can provide members from different international content communities around the world with the opportunity to meet, discuss, share, and trade in the Asia Pacific region. There are many sessions on Jaktent website for users to choose to watch. However, the wide variety of sessions and the different characteristics of presenter speeches have brought many selection problems to website users. At the same time, the popularity of COVID-19 has also made great changes in the form of Jaktent sessions. chatbot, as well as humanized communication and goal-oriented features, can help Jaktent users to solve problems encountered in the use of the website, and can greatly improve user experience.

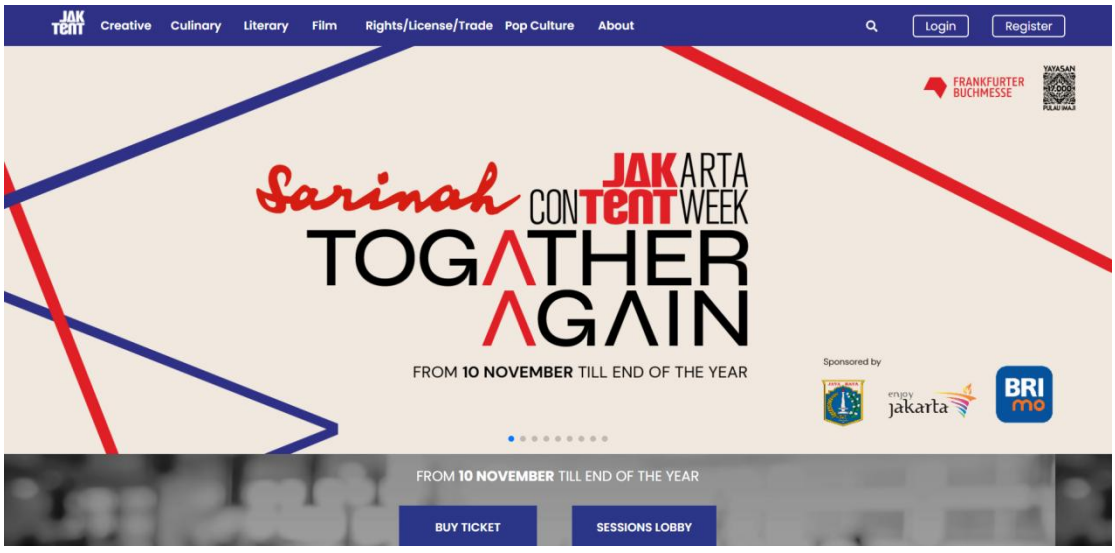

Figure 1: Jaktent Website Interface

Our team's project mainly uses an agile development method. In the early stage of the project, we mainly learned some relevant background knowledge, and at the same time tried to use some open source chatbot frameworks to test some simple corpus, so as to further deepen the understanding of the working principle of chatbot.

After we had a certain background knowledge, we crawled the data from the Jaktent website, and according to the characteristics of the website content and data, we finally chose the most suitable model and developed a chatbot for the Jaktent conference website. During the whole project process, we also made certain improvements to some project plans according to the issues we encountered in actual development. One of the most significant changes in the entire project is that we further developed a Jaktent index website according to some defects of the Jaktent chatbot, so as to maximize the user experience (see Figure 2).

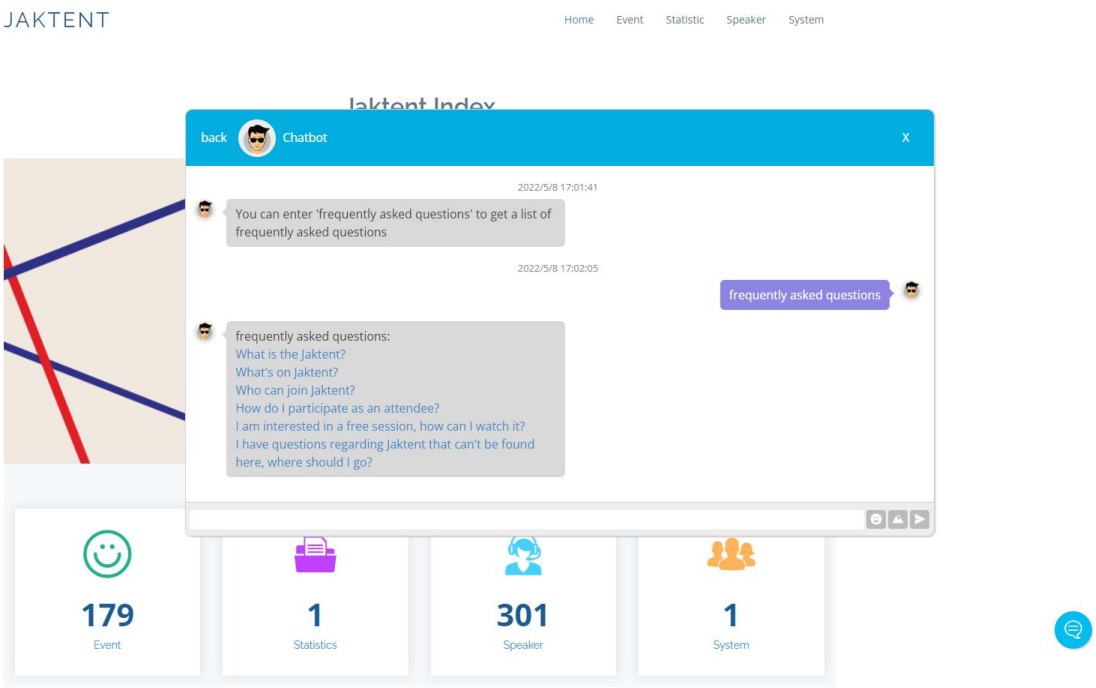

Figure 2: Jaktent Chatbot and Index Website

The Jaktent Chatbot and Index Website we have developed meets the requirement of our client and is capable of Jaktent users to use the website easily and find out the information they need. The main purpose of this reflective report is to reflect on the importance of our R&D project work, at the same time summarize some of the experience and lessons I have gained during the entire project development process, and identify the direction for further improvement in the future.

2. Project Evaluation

2.1. Project Achievement Evaluation

Project Goals:

The goal of the project is to create a chatbot for a virtual conference and exhibition called Jaktent, and use its conference materials and contents as training and examples for such chatbot configuration.

Project Characteristics and Requirements:

1. Provides links to conferences and exhibitions
2. Provide guidance on website services(Account registration etc)
3. Respond accordingly to the context of the user
4. Transfer manual customer service

Figure 3: Project Goals and Requirements Source: Proposal for Chatbot Project

Figure 3 shows the project goals and specific outcome requirements we defined at the beginning of the project. Overall, by the end of the project, our team had achieved the basic goal of developing a chatbot for the Jaktent conference website. After the project is deployed and launched, the chatbot can help users solve the problems encountered in using the Jaktent conference website, thereby improving the user's website experience. At the same time, through this project experience, our team systematically learned and mastered the relevant technical framework of chatbot and was able to choose the most suitable technology according to the actual situation. For example, in the process of developing a chatbot for Jaktent, we made a comprehensive evaluation according to the characteristics of the website data we crawled, and finally decided to use the rule-based chatbot model on some frequently asked questions and use the LSTM deep learning based retrieval method to develop the custom chatbot module, and the final effect was very good.

We also made full use of critical thinking through the project. After the development of the chatbot, we analyzed the shortcomings of the model. For example, in real life, users are unlikely to enter the full name of the Jaktent session and then ask the chatbot for detailed information about that. These all affect the actual user experience. Therefore, we further developed the Jaktent index website, which can search for sessions and presenters based on keywords, and can recommend suitable sessions to users to a certain extent, which further improves our project results.

In general, we have basically realized the characteristics and requirements

originally defined in the project proposal. For presenters and sessions that Jaktent users want to know, the chatbot can display the corresponding network links of detailed information to users; For some services provided by the website, the chatbot can give some predefined guidance; At the same time, when users ask questions online, the chatbot can respond quickly to users to help them solve the problem. The only thing that we didn't realize is the online human customer service, but actually, we discussed this issue with the client at the beginning of the project. The client thought that this function was not needed yet, so we had not done this function. Overall, the whole project has achieved the goals we expected in the project proposal. At the same time, we have further improved the project on the premise of completing the basic goals.

2.2. Evaluation of the Significance of the Project to the Organization

First of all, for our client, the chatbot project meets the needs of our client in the short term, because the Jaktent chatbot we developed for them can help Jaktent users solve the problems encountered in the actual use of the website, so as to further improve the user experience when using the website. And from a long-term prospective, the deployment of the Jaktent chatbot will attract more people to participate in and watch Jaktent online sessions in the context of the COVID-19 pandemic, as users no longer need to worry about the problems they encounter while using the website. With the help of the Jaktent chatbot, users can browse relevant content and sessions more easily on Jaktent conference website.

In addition, for our entire project team, through the entire eight-month R&D project experience, our biggest gain in the short term is to learn and master some core technologies of chatbot, such as artificial intelligence, natural language processing, etc. At the same time, through this chatbot project, we have improved our ability to apply our expertise to solve real-world problems. I think these will be of great help for us to continue our graduate studies and participate in practical work in the future. From a long-term perspective, I think the most important point of this project is to improve our teamwork ability. We are not only doing projects and learning

professional knowledge, but more importantly, we have mastered project management through teamwork. At the same time, through each team meeting, the communication ability has also been improved. I personally think that the most significant improvement of this chatbot project is at this point, because in the future we will face large-scale projects, and we must collaborate in teams. Therefore, the improvement of team collaboration and project management capabilities is of great significance to our long-term development.

3. Link between Theory and Practice

3.1. Important Theory Analysis of the Project

Throughout the project, I think the core theory involved in our chatbot project are mainly divided into three areas: the overall project framework which is built using Python flask; the part of chatbot which mainly adopts the retrieval model based on the combination of rule-based and deep learning models; the label-based recommendation algorithm which is the most significant point in Jaktent index website part. I will focus on analyzing these three aspects in this part of the reflective report.

①Python Flask Technology

Flask is a lightweight web application framework written in Python. Its biggest advantage is that it is flexible, lightweight, open source, and easy to use(Lokhande et al., 2015). It is very suitable for the development of small and medium-sized projects.

We consider that our project mainly includes a Jaktent chatbot and the subsequent further development of Jaktent index website, which is a lightweight small website. In addition, due to the teamwork and the need to complete a small website with rich functions in a short time, after comprehensive evaluation, we finally chose Flask as the general framework of the project. In the development of the project, we also deeply appreciate the convenience of the Flask framework. For example, we can add corresponding plug-ins according to our own needs, so that we can quickly realize our functions; At the same time, only a few Python statements can combine the function codes written by different team members, which is very convenient and

saves a lot of time in integrating code. I think in the future project development process, we can take Flask as the general framework of the project when we encounter some small and medium-sized projects such as our chatbot project.

②Chatbot Part

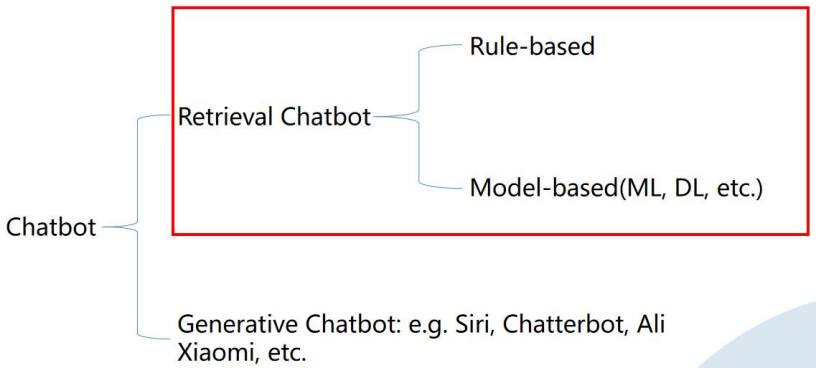

Figure 4: Chatbot Category

Figure 4 shows the categories of chatbot we summarize. From the technical level, chatbot can be divided into two categories: retrieval and generative chatbot. At the initial stage of the project, we have carried out systematic research on these two types of chatbot. First of all, we need to be sure that if we only analyze the effect, the generative chatbot must have better performance, because this kind of chatbot can carry out self-training according to the corpus, and can realize the function of automatic dialogue understanding and response through certain training. However, the premise of realizing automatic dialogue understanding and response is that there is a very sufficient corpus for training. Our project is to take Jaktent conference website as an example to learn how to use chatbot and natural language processing technology to solve practical problems. The corpus and dataset involved are not sufficient, which is why we excluded the technology of generative chatbot from the beginning of the project.

Retrieval chatbot can be mainly divided into two categories: rule-based and model-based. In response to the question of which type of chatbot category to use, we finally considered the combination of rule-based and model-based chatbot technologies in the project. For some Frequently Asked Questions(FAQ), the rule-based mode is adopted, and the sorted questions and answers are all written into JS files and displayed on the front-end interface. The rule-based mode is suitable for

some pre-defined question and answer scenarios, and its biggest advantage is that there is a pre-set question and answer template for matching. But its biggest disadvantage is that it has poor scalability and is only suitable for specific chat scenarios. On the FAQ side, however, using the rule-based model is very convenient because the questions and answers are pre-set. Rule-based chatbot prediction is most accurate if we only need to know the answers to some fixed questions.

The custom chatbot adopts a model-based approach. In our project, we mainly use the deep learning model of LSTM to develop this function. The biggest advantage of the deep learning model is that it can process corpus with a large amount of data. At the same time, because the LSTM model has the function of long-term memory, it can better predict the question answer through the context(Su et al., 2017), so it is very suitable for the function of custom chatbot. However, during the development process, we also discovered the problem of chatbot based on the LSTM model, that is, the model training is time-consuming and prone to gradient explosion problems. Because the data on the Jaktent conference website is not very large, this problem has not appeared for the time being. But if the amount of data increases in the future, we must also consider more advanced models than LSTM. In conclusion, the effect of the LSTM model in the custom chatbot part of Jaktent is very successful.

In general, the comprehensive use of rule-based and model-based chatbot technologies according to different scenarios can give full play to their different advantages and maximize the performance of Jaktent chatbot.

③Recommendation Algorithm in Jaktent index website

One of the most critical technologies in Jaktent index website is to implement the function of recommending Jaktent sessions for users. During the project development, we used a label-based recommendation algorithm to label all Jaktent sessions and performed cosine similarity processing on all labels to recommend the most similar sessions to users. This label-based recommendation algorithm can accurately locate user preferences and implement recommendation functions based on label similarity(Sharma & Gera, 2013), but at the same time, due to the lack of more user behaviors, the performance of the recommendation system will also have great

limitations. But I must point out that because of the limited number of sessions on the Jaktent website and the lack of user behavior records, the recommendation system can only recommend based on session names for the time being. But overall, this function actually makes up for a big shortcoming that chatbot cannot set up the session recommendation function, and the starting point is still good. After the system is deployed in the future, when user behavior gradually increases, client and developer can further improve the algorithm and the performance of session recommendation.

3.2. Critique of the Research and Development Methodology

Unlike normal software development, which is divided into functional modules from the beginning, our chatbot project adopts a "Research to Development" step-by-step and incremental development method. In the initial phase of the project, we spent much time researching different kinds of chatbot technology frameworks and exploring their corresponding advantages and disadvantages. When we have mastered enough background knowledge, we can use the most suitable technology to develop chatbot according to the actual situation of the Jaktent conference website. At the same time, we can also comprehensively analyze the defects of the Jaktent chatbot, and further develop a Jaktent index website on the premise of meeting the basic requirements. This development method will consume a lot of research time in the early stage, however, through the independent research of the team, we can step by step improve our relevant professional skills, and can accurately grasp the core problems during formal project development. Because of this, we were able to finalize the development of the project very efficiently in a short period of time, and to great effect. This research and development methodology will be useful in the future project development, especially for projects involving relatively advanced technologies.

4. Personal and Professional Development

My plan after graduating from university is to go abroad to continue my master's degree and further study in the direction of artificial intelligence. However, I have studied few AI courses in my four-year undergraduate course and lack of experience

in team project cooperation, which will bring great difficulties to my postgraduate study in the future. This is also the reason why my team and I finally chose this chatbot R&D project.

Chatbot is a very important application scenario for natural language processing, and involve a lot of background knowledge. First of all, developers need to have a solid Python programming ability, at the same time need to master important machine learning and deep learning algorithms, and also need to have some natural language text processing skills. I think through this chatbot R&D project, my Python programming ability has been greatly improved. At the same time, I have mastered some basic machine learning and deep learning algorithms, and can flexibly combine the knowledge of natural language processing to solve some practical problems. But I think at this stage, I can only be regarded as just getting started in the field of artificial intelligence, which is still very far from being proficient. First of all, I still only stay at the application level of many machine learning and deep learning algorithms, and my understanding of the principles is still not thorough enough. Sometimes I often encounter some problems that I cannot understand many mathematical formulas, which seriously affects my understanding of algorithms and basic concepts. Artificial intelligence has very high requirements for mathematics. I think I still need to further improve my mathematical ability in the future, and further study and learn important machine learning and deep learning algorithms. I can improve these skills through regular practice. For example, for some mathematical formulas, I can first deduce them step by step according to the tutorial, and then use them in practice after I am proficient. Only by fully understanding the algorithm can we grasp the essence and use it flexibly in the future development process.

In addition, in the future master's stage, I still need to dabble in some of the latest AI algorithms in my daily life. Because the development of artificial intelligence is very fast, for example, the LSTM model we used in the project was actually first used by some researchers in the field of deep learning in 2013. After that, many newer NLP algorithms have been invented, such as BERT, ERINE, etc(Ezen-Can, 2020). The effects of these algorithms are far more than LSTM. From here, I can feel the fast

update speed of AI algorithms. Only by continuous learning can we not be eliminated by the times.

5. Evaluation of the teamwork

As the leader of the Chatbot Project Team, I think I play this role well throughout the R&D project. I can communicate with client and supervisor regularly, organize team meetings and negotiate time. At the same time, during the normal project development process, I can effectively assign work to team members in real time, and regularly track the progress of the entire project.

I think all members of our team can participate in the work of the team project very well. Although in the early stage of the project, two members participated in less teamwork because they needed to participate in the postgraduate entrance examination. However, after the project officially started development, each member of our team can complete their own part carefully and efficiently, and we often discussed the problems existing in the project together, and regularly reported the work progress to our client and make further improvement according to our client's suggestions, which is also the reason why we can finally complete the chatbot project with high efficiency, quality and quantity. Throughout the project process, I often interacted with my other team members to understand their problems and provide some targeted help, which also improved my communication skills to a certain extent.

Analyzing the problems we have in the entire team project, I think that our project management skills need to be further improved. In the early stage of the project, we don't know how to deliver the project staged achievements, when to have a progress meeting and how should it be done. But in general, in the later stage of the project, our work in project management has been greatly improved. We have regularly organized team meetings to report on our work progress, so that customers can know our progress and give some guidance. The quality of project management skills can greatly affect the progress of the entire project and the final deliverables, so we still need to continue to improve this skills in the following work.

Another problem, which the client also pointed out, is that the team members could be more active in the team meeting. I also noticed this problem, because in daily team meetings, it was often me as the leader who reported our work to the client alone, and there were two members who hardly interacted with each other. I think this is a very important issue, because in team meetings, everyone should actively participate and interact, so that we can better grasp the problems that exist in our teamwork.

But overall, through this R&D project, our project management skills and teamwork ability have been greatly improved. This R&D project is a very valuable experience for me, because when we enter the workplace in the future, most software development projects need teamwork. Only by continuously improving our teamwork and project management ability can we give full play to our respective talents in team projects.

6. Summary and Conclusion of Total Project Experience

In conclusion, our chatbot project met our client's requirements and achieved the goals we expected at the beginning of the project. Jaktent chatbot can help users use the Jaktent website and solve their problems in the process of using it. At the same time, we have developed a Jaktent index website on the basis of chatbot to make up for the shortcomings of Jaktent chatbot. The combination of chatbot and Jaktent index website will bring great convenience for users to use the website and participate in Jaktent sessions in the future.

Throughout the R&D project, through the step-by-step and incremental development method of "Research to Development", we have mastered the working principle of chatbot and the relevant knowledge of natural language processing, and have broadened our horizons and learned a lot of cutting-edge chatbot framework. At the same time, during the process of the project, my Python programming ability and professional knowledge in artificial intelligence have been greatly improved, and I have also found my current shortcomings in the process of the project, which provide

a direction for my further study and improvement in the master's stage in the future.

As a team project, each team member cooperated and helped each other, and we handled the communication and relationship with client and supervisor very well. During the whole project process, as the project leader, I have improved my project management ability very well, and learned how to plan and track the project progress. At the same time, in the process of communicating with client and supervisor again and again, I am constantly improving my team communication skills, which will be of great help to my future study and teamwork.

Overall, this R&D team project is a very valuable experience for me. Whether it is the improvement of professional skills, project management or teamwork skills, it will be of great help to my further study and work in the future. At the same time, the problems and shortcomings found in this team project also need to be improved step by step in my future practice.

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