COMP9900 PROJECT PROPOSAL

ASSISTANT FOR PREPARATION FOR RADILOGY EXAMINATION

GROUP NAME: TQL

GROUP MEMBERS: Z5147976 Tingfeng Lin
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Z5156244 Yousheng Sui
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1. Background

With the improvement of people's living standards and the development of medical technology, more and more patients choose to diagnose their diseases through some complicated medical examinations. For example, conventional radiology, CT, MR, ultrasound, nuclear medicine, radiation therapy, interventional therapy, etc., these radiological techniques are currently effective adjuvant treatments for clinical treatment. At the same time, complex medical examinations require patients to be properly prepared before the visit, because different radiological imaging principles and models are different, patients need to do different preparations.

Many hospitals also provide radiology guidelines on their websites, but each patient has a different physical condition. At the same time, patients also belong to the group lacking professional medical knowledge. The analysis of the specific situation, the instructions on the website alone, does not meet the patient's needs. Due to the lack of understanding of the preparations for radiological examinations in many patients, delays or cancellations have occurred usually. This not only delays the patient's treatment time, but also reduces the efficiency of the radiological examination. The problem that patients and hospitals face is one that our team intends to address.

2. Aim

In order to better help patients to see patients on time and improve the efficiency of radiological examination, a smart online booking radiology inspection website came into being.

1. Enable a user to get the useful tips about physical health

The website will provide basic information about several radiological examinations and preparation guides for reference. Patients can search the website for the appropriate information they want to know.

2. Assistant chatbots help patients prepare radiology examination

The assistant robot is provided to answer the patient's problem, and the assistant robot can conduct a simple conversation with the patient, ask the patient's physical condition, and prepare the personal information before the examination.

3. Help the patients to book a radiology examination

The patients can make a reservation by the assistant robot including choosing the preferred radiologist. This website is a great way to help patients who lack medical expertise to prepare for exams and make appointments.

2.1 Design/Flow

The design of the website is not only the composition of the code, but the layout of the user interface, the matching of colours, the selection of buttons is also an important part of the website. How to design a web page with excellent user experience is also our key goal. Besides, how to have a proper conversation and reservation with the chatbot is also a problem we need to solve. For the patient's online booking system, the comfortable pages and the form of inspiration is our choice.
Flow is closely related to the design. The whole reservation process is reasonable and smooth, and accurate and appropriate information is the key to the success of the whole website. The most important flow is the chatbot and the patient had a reasonable and smooth conversation. The overall team will use case studies, design guidelines, and the latest design standards framework to design a user-friendly website.

2.2 Scope/Technical Details

About the project scope, our team have been decided to design a website chatbot based on Python. Flask has a RESTful extension that adds support for fast build REST APIs, making front-end and back-end development easier. In addition, using the HTTP or HTTPs protocol, the data transfer format uses JSON.

3. Project choice

Our team chooses projects according to two aspects: one is our interest in and understanding of the project. For the reservation management system, the team members have certain experience, and the chat intelligent robot is also our interest. Second, the advantages and disadvantages of the team members themselves, we are more inclined to the design of high technology, whether it is the background of high technical difficulty or the frontpage design, data capture, four members can play their advantages.

4. Epics

4.1 Log in and Sign up

In our home page, if the user has an account, click the login button to choose as a patient

or a doctor. If login as a patient, after inputting correct account number and password, the user would have full function of our website. If login as a doctor, the user could have the additional ability to check his/her agenda and many more.
If the user does not have an account, he/she would be treated as a guest. Guest-only has limited ability to browse the website to look up information regarding as our introduction. Also, a user could click Sign up button to create his/her account, after through a few simple steps, the user will be able to use our website in full function.

4.2 Booking

When patients want to book an appointment, the chatbot will ensure whether patients have limits about clinic distance or radiologists, then chatbot applies those requirements to data in the database and returns available time slots and radiologists. After patients choosing preferred appointment, chatbot sends a confirmation message to the corresponding radiologist. Patients will be notified by an email if the radiologist confirms the appointment.

4.3 Chatbot

There is a trained Deep Learning network model in the chatbot. For those specific functions such as booking or showing reservations, when chatbot receives a request from users, it transfers the request to the model. DL model distinguishes what the request means and return a flag telling chatbot what it should do for the user. If patients have requirements about distance or radiologists etc., the chatbot interacts with users by dialogue flow and restricts output from the database. What's more, the chatbot provides necessary preparation information to patients after they chose a specific radiology examination. At the same time, the chatbot asks some basic questions to help patients prepare radiology examination better and additional questions from radiologists are possible.

4.4 APIs

- User login and registration API: when user login to the system, first, we would like the user to enter the username and password. Obviously, this is a POST request. After checking the authentication, users can do further operations. Registration API is used for creating a new account for a user.
- Chatbot API: The respond of the chatbot is implemented by calling different API. This enables chatbot to communicate online with users.
- Appointment checking and cancellation API: after user login to the system, user has permissions to update and cancel their bookings.

4.5 Data Extraction

Data extraction is the key function in this project. Doctors' information, clinics information and examination checking preparation information extract from the external data sources. Not only extracting information but only data cleansing is also an important procedure.

4.6 Test

A robust system can handle hundreds of thousands of requests at the same time. In this project, we will try to use unit testing and performance testing to check the system functionality. LoadRunner will be used for testing.

4.7 System Architecture

Our system contains four main parts, API module, front end (UI) module, data extraction module and chatbot module. Between the API and chatbot module, we are going to use a middleware layer, which consists of a relational database (MySQL) and a cache database (Redis). By using these two software, our system is much more robust and can handle more request simultaneously.

- The UI module is responsible for handling the user's interaction and getting the response from the backend to the frontend. In order to make this project more realistic, we would like to make an official website for this project.
- The chatbot module can provide high accuracy and most relevant answer to users. NLP technique will be applied to this chatbot. To train this chatbot, several phases such as data cleansing, keyword extraction, synonym matching, and post processing might be implemented in this system. This module will be also connected to the middleware module.
- Data extraction function can be seen as the preprocessing of the chatbot training. It will extract the data from external data sources. We intend to extract relevant information from different clinics and hospitals and also filter some meaningless data. In order to build a data extraction function, we are going to create a web scraper using the third-party library (BeautifulSoup) to extract all relevant information from websites. The captured data will be stored in a cloud-based database (MySQL).
- API module is the key component communicating the frontend and backend. In this project, the backend system will be implemented using Python flask framework. In building applications, backend system can only expose an URL to frontend. It is useful for decoupling different modules. The logical structure of the system is shown in the following figures

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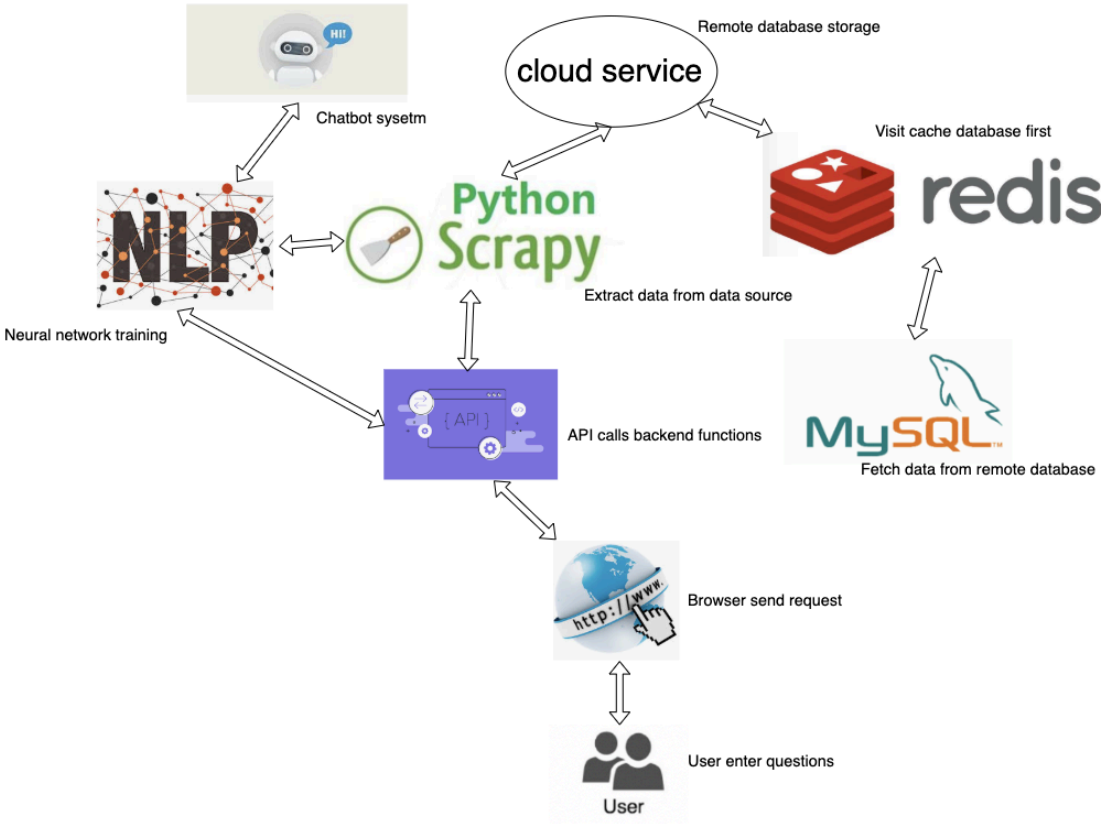
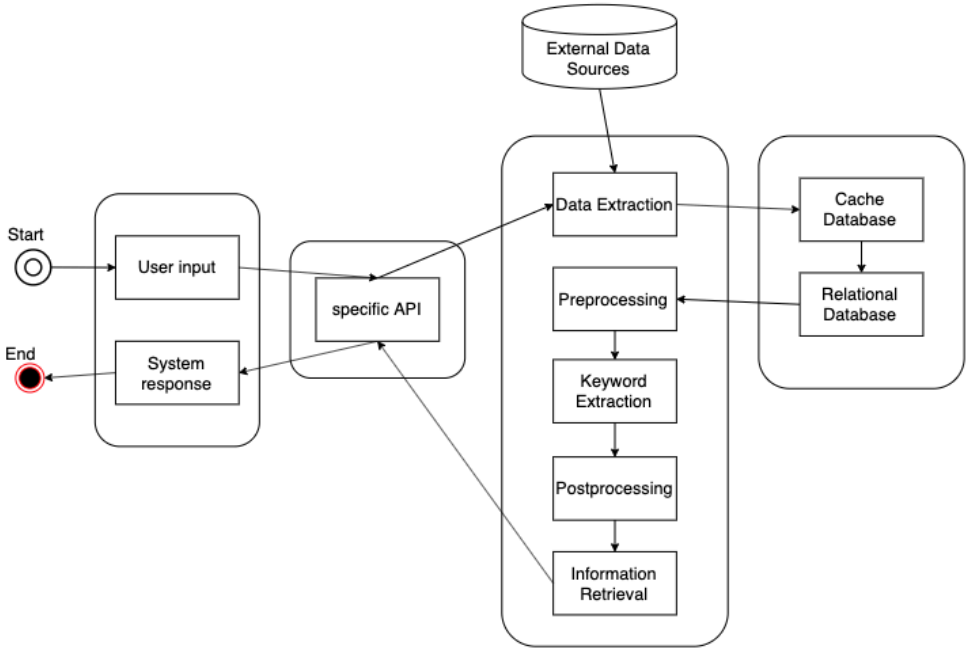


Graph1: Technical Details



Graph2: Dataflow

5. Team Skill Set

5.1 Project Methodology

Code management: Github
GitHub is the most popular platform for software developer to share, build and discover e ngineering.

Program language: Python, JavaScript, SQL

Scrum: Trello
Trello is a web-based list-making application. It can be used for assigning tasks to group members and manage the tasks status.

Testing: LoadRunner
LoadRunner is a software testing tool. It is used to test the system, measuring system behavior and performance under load.

Libraries: Flask, NumPy, Pandas, Pytorch, etc.
NumPy and Pandas are very useful libraries of Python, especially in data science fiedand Flask contributes a lot in building Web APIs. Compared with TensorFlow, Pytorch is equ ally powerful and more friendly to deep learning novices.

5.2 Project requirement

Non-functionality requirement：

Reliability：

The system will be accessible100% of the time
The mean time between failures is required to be no less than one week
The system crash should be extremely low and never loss or leak data.

Security：

A password must be entered to use the system
Users can only modify and collect their own data

6. Risk Management

Risk is the uncertainty that leads to project failure. Risk management can help us complete tasks on time and in volume. There are some risks listed below may occur in our project.

Risk Event	Likelihood	Impact	Ranking	Response
Some bugs we may not detect	3	5	1	Enough test
Underestimation of the time/resource commitment	2	4	2	Careful schedule
Group member Absence	1	3	3	Flexible meeting time
Too many compromise	3	2	4	Set some core functions

7. Project Schedule

Our team use the agile project management method. According to the characteristics of agile project management, our team completed the project plan in five stages.
1. Conception: determine the product conception, the scope of the project and the way the team works together.
2. Speculation: develop function-based vision plans, milestones, and iteration plans to ensure delivery of the envisioned product.
3. Exploration: provide tested functionality in a short period of time, continuously working to reduce project risks and uncertainties.
4. Adaptation: review the submitted results, current situation and team performance, and make adjustments if necessary.
5. Termination: terminate the project and exchange major learning achievements.

7.1 Stand-up

We will use the Trello tool to get track of our sprint. Besides, we will have meetings during the week. Codes will be committed to the Github that has been set up.

- Monday: In person.
- Wednesday: In person.
- Friday: Online.

7.2 Sprints

Monday 30th September	Discuss project proposal	Week 3
Monday 7th October	Design APIs and search data	Week 4
Monday 14th October	Web development and progress demo	Week 5
Monday 21st October	Web development and search data	Week 6
Monday 28th October	Chatbot module and progress demo	Week 7
Monday 4th November	Chatbot module	Week 8
Monday 11th November	Integrate frontend and backend	Week 9
Monday 18th November	Testing and project submission	Week 10
Monday 25th November	Presentation	Week 11

7.3 Weekly meeting time

- Monday: lab 12:00-14:00
- Friday: Afternoon

8. Team Profile

Characteristics:

Tingfeng Lin	Web develop, backend develops, Microservice develop
Yi Xiao	Machine learning, Algorithm
Yousheng Sui	Frontend develop, UI designer
Yan Duan	Reporter, UI designer

Role:

Z5147976	Tingfeng Lin	Scrum master and Developer
Z5125251	Yi Xiao	Developer
Z5156244	Yousheng Sui	Developer
Z5145036	Yan Duan	Developer