

Development of a Virtual Patient Model for Kampo Medical Interview: New Approach for Enhancing Empathy and Understanding of Kampo Medicine Pathological Concepts

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- In recent years, complementary and alternative medicine use has increased worldwide.
- Kampo medicine is particularly trusted and widely used in Japan.

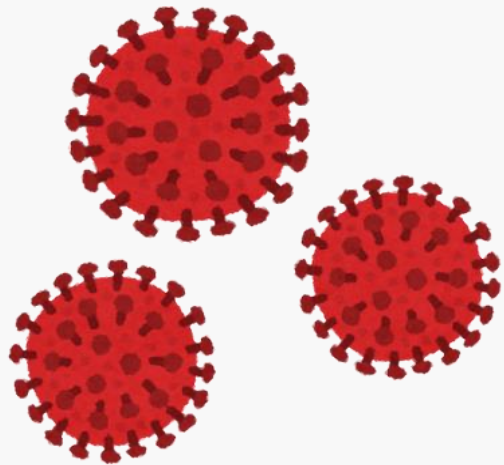
Kampo medicine

- Medicine traditionally practiced in Japan, based on ancient Chinese medicine.
- The diagnosis is based on questions about the degree of body coldness and related symptoms.



- Medical students' opportunities to conduct interviews primarily depend on clinical practices in Kampo medicine.
- There had been some restrictions imposed on clinical training as infection control measures due to the COVID-19.

COVID-19



Clinical practice



Introduction

- If a pandemic situation like COVID-19 occurs again, restrictions will once more be placed on clinical training.



Solution

- Introduction of virtual patients.
- In recent years, medical education using virtual patients has gained attention.
- Research on Kampo medicine education using virtual patient has not been conducted.

Virtual patients

- Virtual entity
- That can conduct medical interviews

Virtual patient used in this study

- Can have conversations using voice
- Respond according to the scenario
- Facial expressions changes

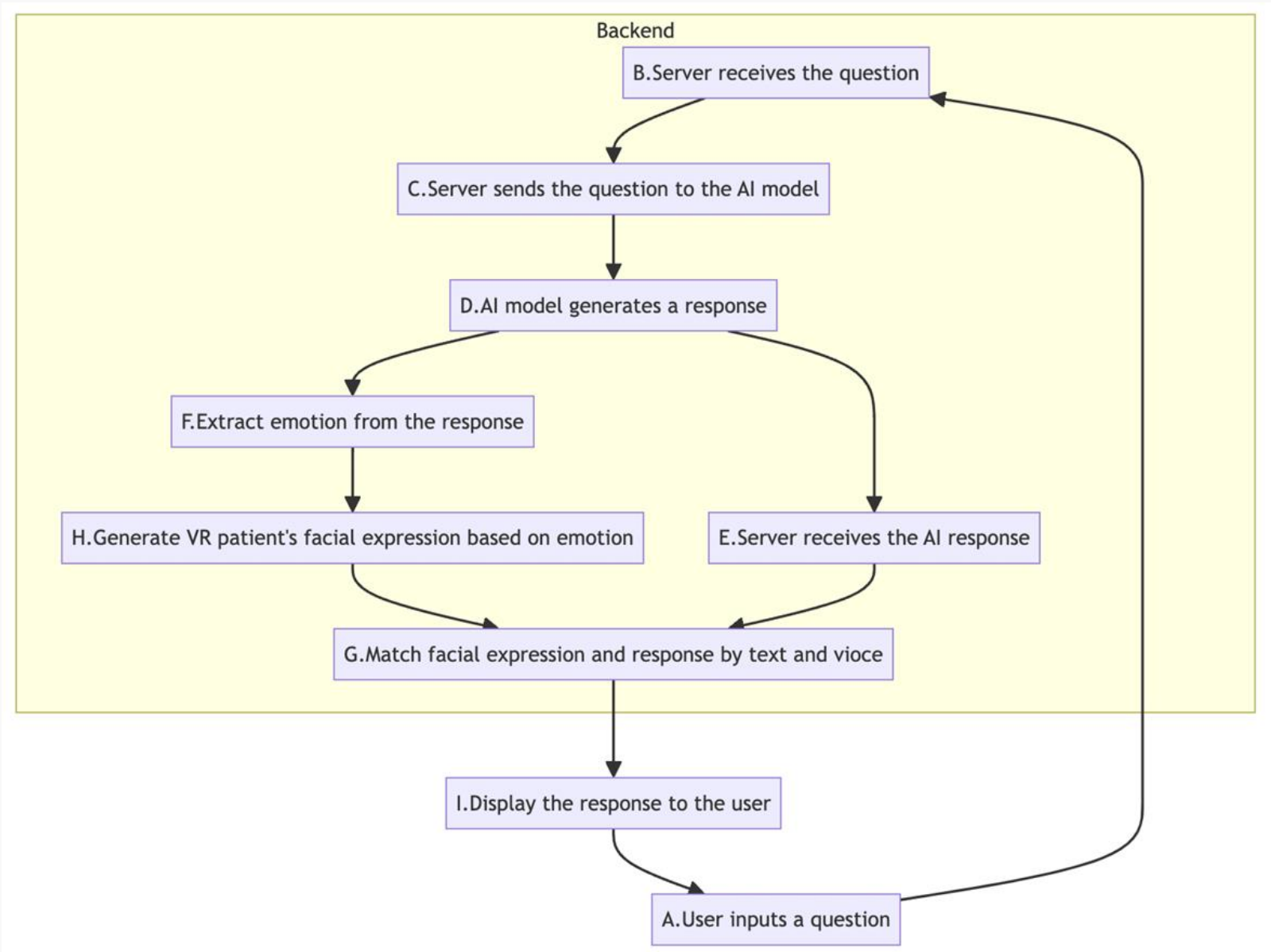
General objective

- To develop virtual patients for Kampo medicine interviews and verifying their educational effectiveness for medical students.

Current stage

- To ensure that generative AI accurately understands the emotions expressed in the conversations generated from the provided scenarios and synchronizes the virtual patients' facial expressions to match those emotions.

Flowchart of the Virtual Patient



- A scenario in which medical students ask specific questions about Kampo medicine pathology to patients with particular complaints or symptoms, and patients respond accordingly.

Symptoms of Individuals Prescribed Ninjinto



- Decreased physical strength
 - a tendency to easily become fatigued
 - sensitive to cold
- and
- Loss of appetite
 - Stomach heaviness
 - Diarrhea

- **Reference:** medical interview for a patient prescribed Ninjinto
- **Subject:** male in his late 60s
- **Main complaint:** discomfort in the stomach and loss of appetite
- **Scenario creation and supervision:** discussion among four Kampo medicine specialists and multiple sessions

NO	Physician	Patient
1	Are you experiencing any other symptoms?	I get tired easily.
2	Do you experience nausea and vomiting?	I do not have nausea or vomiting.
3	Do you have an appetite?	I don't have much of an appetite.
4	Do you eat sweet foods?	Yes, I do.

- To build a system allowing a conversation with virtual patient, we integrated ChatGPT API and Google Cloud Speech-to-Text API.
- VOICEVOX, a speech synthesis software, was used for the speech output.
- **Speech Recognition:** Google Cloud Speech-to-Text API
- **Response Generation:** ChatGPT API
- **Speech Output:** VOICEVOX

- 1** Estimate the emotions contained in the generated responses
- 2** Select the most strongly expressed emotion
- 3** Adjust the virtual patient's facial expressions according to the emotions

- Using ChatGPT, we design a prompt to output the six selected emotions on a scale of 0 to 10 based on the generated text.

```
{  
    "Emotion": {  
        "Happiness": 0~10,  
        "Sadness": 0~10,  
        "Anger": 0~10,  
        "Fear": 0~10,  
        "Disgust": 0~10,  
        "Surprise": 0~10,  
    },  
    "Message": "Response"  
}
```

Input

- Several questions



Virtual patient



Output

- Generated responses
- Emotion estimation
- Facial expression changes

Facial expression changes

Neutral



Changes

happiness, disgust, sadness, anger

Question	AI's response	Estimated emotion					
		Happiness	Sadness	Anger	Fear	Disgust	Surprise
Q1	Ans1	0	0	0	0	0	0
Q2	Ans2	0	3	0	0	0	0
Q3	Ans3	0	2	0	0	3	0
Q4	Ans4	5	0	0	0	0	0

Q1: How is your stomach?
Ans1: I'm not feeling well in my stomach.

Q2: Are you in pain?
Ans2: Yes, it hurts a bit. I hope to get better soon.

Q3: Do you have an appetite?
Ans3: I don't have much of an appetite. I'm not feeling well in my stomach, so it's a bit hard to eat.

Q4: Do you like sweets?
Ans4: Yes, I do. I especially like Manju, Dorayaki, and convenience store desserts.

Results of Facial Expression Changes

Ans1: I'm not feeling well in my stomach.

Emotion: Neutral



Ans2: Yes, it hurts a bit. I hope to get better soon.

Emotion: Sadness



Ans3: I don't have much of an appetite. I'm not feeling well in my stomach, so it's a bit hard to eat.

Emotion: Disgust



Ans4: Yes, I do. I especially like Manju, Dorayaki, and convenience store desserts

Emotion: Happiness



Discussion on generated responses and emotion estimation results

- Emotion estimation was successfully performed in practice.
- Results yielded responses close to the scenario.

Only responses close to the predetermined answers were output.

Discussion on results of facial expression changes

- Effectively changed in response to the created expressions

The degree of facial expression changes does not match the numerical values.

- To pursue greater realism akin to actual patients
- To align facial expression changes with emotion scales
- To expand the variety of symptoms and cases through different scenarios
- To plan a behavioral experiment targeting medical students, that is, comparing the performance of students who trained with virtual patients to those who underwent traditional training methods.

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