Evaluating Assistive Spoken-Dialogue Agent System in Daily Living of Elderly People

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Research Background

- **The population is aging in many countries around the world**
  - Increase in the number of elderly and dementia patients
  - Shortage of nursing homes and nursing personnel
- **Transition from institutional care to home care[1]**
  - Various problems such as the burden of caregiving on the family
  - There are limits to self-help and mutual-help
- **Expectations for technology to support human care**

Previous Study

- **Virtual Agent Listening Service**
  - Service in which agents listen to the elderly
  - The image of Virtual Agent Listening Service is shown in Figure 1

Fig 1. Virtual Agent Listening Service.

- **Effectiveness of this service**
  - Obtain the emotional and living conditions of the elderly
  - Relieve stress by talking

Challenging Points

- **Many seniors are unfamiliar with device operation**
- **There are many useful services on the Internet**
  - Ex) YouTube, Google Calendar, etc.
- → **Provide web services to the elderly without directly operating the device**

Goal and Key Idea

- **Goal**
  - make the elderly and dementia patients to execute web service easily
- **Key Idea**
  - if services can be executed by voice, the elderly can also use them

Approach

- **We achieved this through two approaches**
  - A1: centrally manages user information for multiple services
  - A2: provide services to users by executing API[2] through spoken dialogue
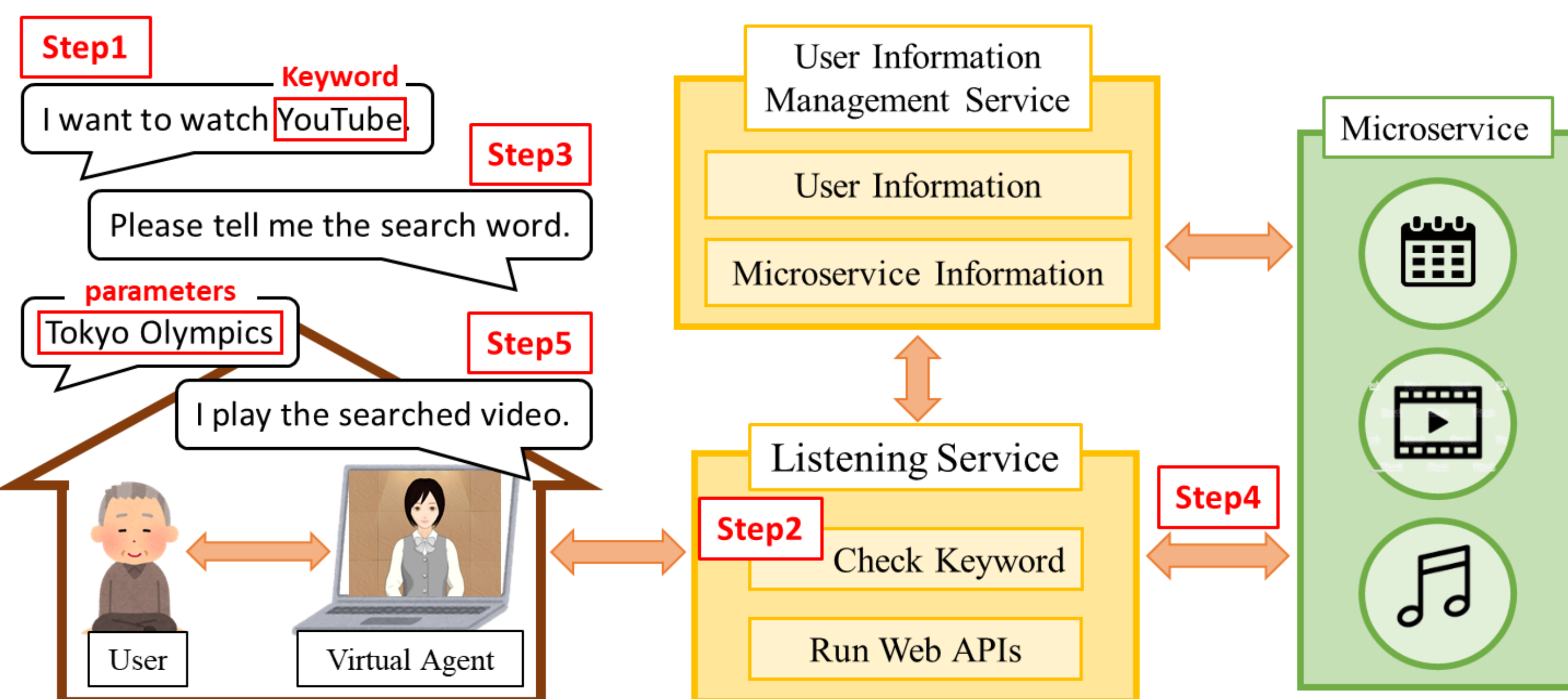- **The architecture of the proposed system is shown in Figure 2**

Fig 2. The Proposed System Architecture.

- **5 Steps to execute services through spoken dialogue**
  - Step 1: User speaks specific keywords to agent
  - Step 2: Agent checks the keywords
  - Step 3: Agent obtains parameters in dialogue
  - Step 4: Agent executes APIs using parameters
  - Step 5: Agent displays the results to the user

Experiment

- **Install the proposed system in the subject's home**
- **The experiment subjects are two men in their 80s**
  - Subject A is a healthy elderly person
  - Subject B is an elderly person with MCI
- **Experimental Details**
  - The experiment period is one week
  - Run each of the linked services at least once during the period
  - The linked services are below:
    - YouTube, Google Search, Google Calendar, and Dialogue Review Service
  - Administrate a questionnaire based on the SQuaRE[3] (see Table 1)

Tab 1. Survey Results (excerpts).

Question	Answer
Do you think the service could have been executed using only speech dialogues?	Yes. Because many parts could be done by speech dialogues.
Do you think it was easy to execute services through speech dialogues?	Yes. Because I didn't have to operate the keyboard.
Do you think executing services through spoken dialogues was helpful?	Yes. Because it is easy to use the services.
Do you think that execution by spoken dialogue was better than manual execution?	Yes. Because voice operation is easier than direct operation.

Results and Discussion

- **Some of survey results for Subject A are shown in Table 1**
  - The proposed system makes the elderly to execute web services easily
- **Number of service executions for Subject A is shown in Table 2**
  - YouTube had the most executed
  - The reason is that he used it for his morning routine
  - → It is effective to link with services used for daily habits

Tab 2. Number of Service Executions.
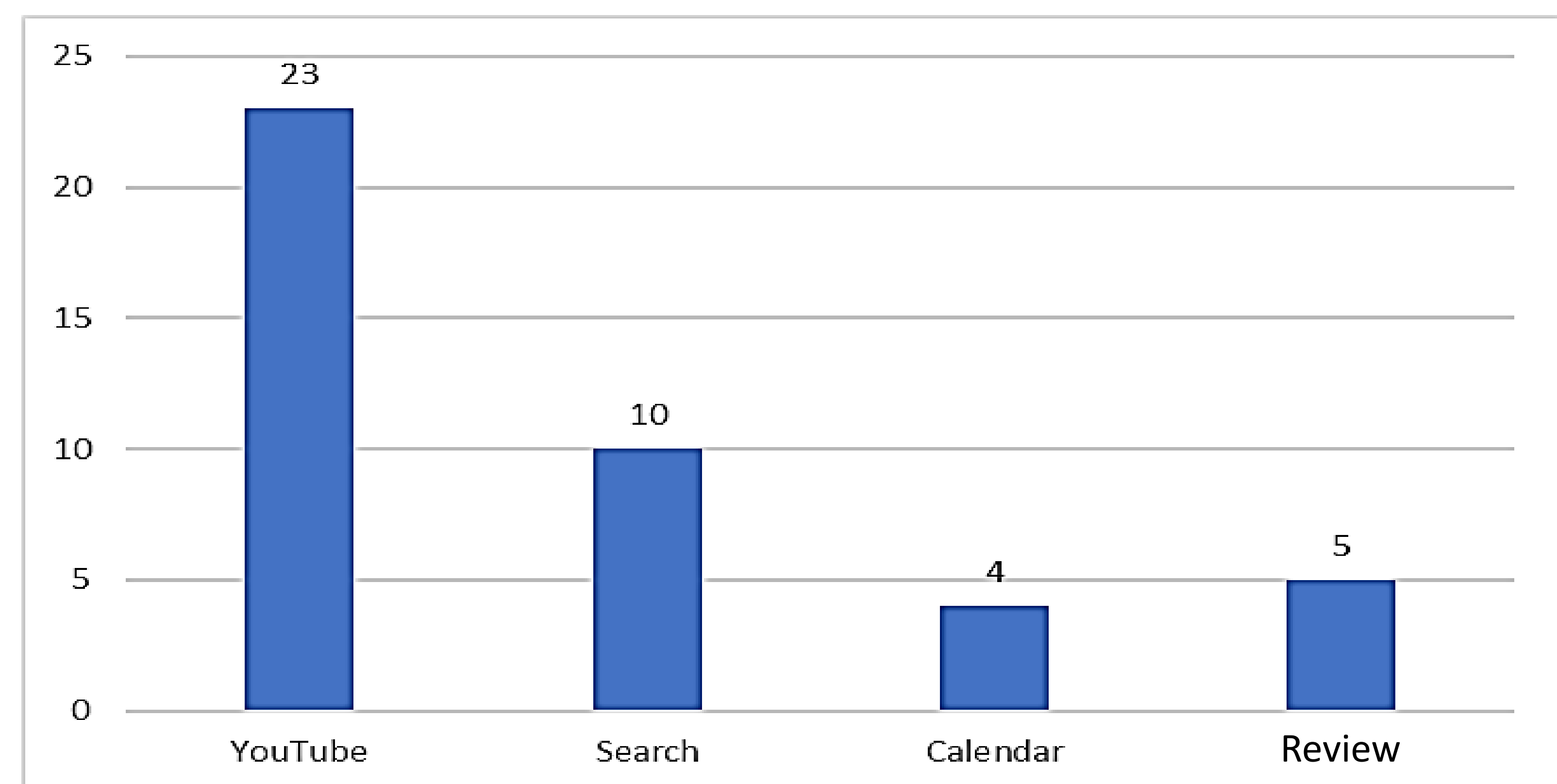
- **Subject B was unable to perform services by voice**
  - Elderly people with MCI were difficult to execute services on their own
  - Subject B could interact well with the agent
- → **It is possible to have MCI patients and dementia patients run services by encouraging the execution of services from the agent's side**

Conclusion and Future Work

- **Conclusion**
  - Proposed the system that executes services using only speech
    - Elderly people can easily run web services
  - Showed the effectiveness of the proposed system through experiments
    - The proposed system has the elderly execute web services easily
  - Not very effective for patients with dementia or MCI
- **Future Work**
  - Ensure that agents encourage seniors to execute services
  - Conduct experiments on a larger number of elderly people

[1]. Song, P et al. (2019). Bioscience trends, 13(3), 279-281.
[2]. Li, J et al. (2019). Building and Environment, 153, 91-100.
[3]. Shtefan, N et al. (2021). Radiotekhnika, (207), 159-165.