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A Study of a Reminder System for Taking Medicine using AI Speaker

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Abstract

In this paper, we propose a reminder system using AI speaker to help patients take medication. For functional extensibility of AI speakers, Google Assistant was installed on Raspberry Pi to configure a customized AI speaker, and Dialogflow was used to configure a dialogue application. Once dosing time and consultation/ check-up schedule related to the disease are registered through the smartphone app, this system enables patients to receive the notification using AI speakers or smartphones. In addition, by utilizing open API-based environmental information like weather forecast, it also provides the precautions in daily life depending on the weather on the consultation/ check-up date, being helpful to health care.

Keywords: Reminder System, Taking Medicine, AI Speaker

I. INTRODUCTION

Dr. Thomas D. Sequist's team at Brigham and Women's Hospital (BWH) reported in the Archives of Internal Medicine that informing patients of the check-up date was effective in increasing the check-up rate of colon cancer. Color cancer is the second leading cause of cancer deaths in the United States. The U.S. recommends adults aged 50 or older to undergo colon cancer check-up, but only 60% of them were undergone at the time of the investigation. However, since the introduction of a reminder system to inform patients of the check-up date, their check-up rate has improved 3.7% for those in their 50s, 7.3% for those in their 60s, and 10.1% for those in 70s to 80s [1].

Taking medicine in proper time alone is a great way to treat the disease, but there are many patients who forget their dosing time.

In this paper, based on these findings, we designed and implemented a reminder system using AI speakers that can help patients take medicine on time. The system informs the patient of dosing time and the date of counseling/check-up, and provides the precautions in daily life depending on the weather information. You can register your treatment schedule and receive notifications not only using your smartphone application, but also using AI speakers at home.

II. RELATED WORK

MyTherapy [2], a medication reminder and healthcare application, records and tracks medication usage and health conditions. It is more than just a simple medication reminder combined with a health diary. Key functions include medication reminder and recording, notification of a wide range of medications, medication history tracking, personalized health diary, sharing the information of whether taking medicine or not with family members and friends, and weight, blood pressure, blood sugar levels for all disease conditions.

The medication reminder system Medisafe [3] is the easy-to-use medication reminder and management application. It provides the management of medication for many complex health conditions, including diabetes, heart disease and cancer, and informs women of the time of taking contraceptives. Connected with Apple's Health application, it measures your blood sugar levels, blood pressure, weight, pulse and temperature, reminds you when you need to refill your pill bottles, displays a list of medications to be taken today, and checks your progress report. In addition, in the paid version, you can sync your family members' devices in real time and automatically back up and restore them to the Medisafe cloud server.

Mr.Pillster [4] application is a mobile assistant that helps you take your medicine on time. It reminders you of medication you already have missed its dosing time or delays the reminding time, notify you the numbers to be taken per day, inform you of the health information of your family members, and records individual or one-time prescriptions.

III. REMINDER SYSTEM BASED ON AI SPEAKER

The hardware of AI speaker-based-reminder system proposed in this paper consists of AI speaker installed with Google Assistant on Raspberry Pi, and motion sensors for movement detection. The software consists of Dialogflow, API server, and database, and provides reminder services to users through a mobile app. Fig. 1 and Fig. 2 show the architectures of the hardware and software of the AI speaker-based reminder system proposed in this paper.

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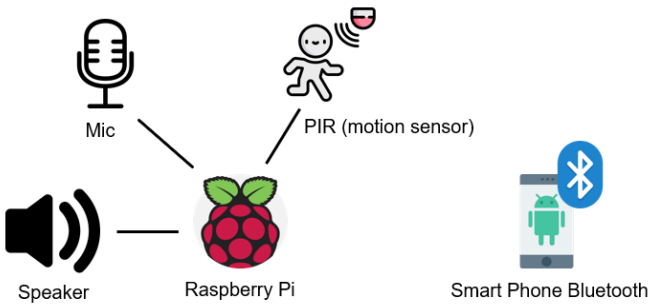

Fig. 1. Architecture of the hardware

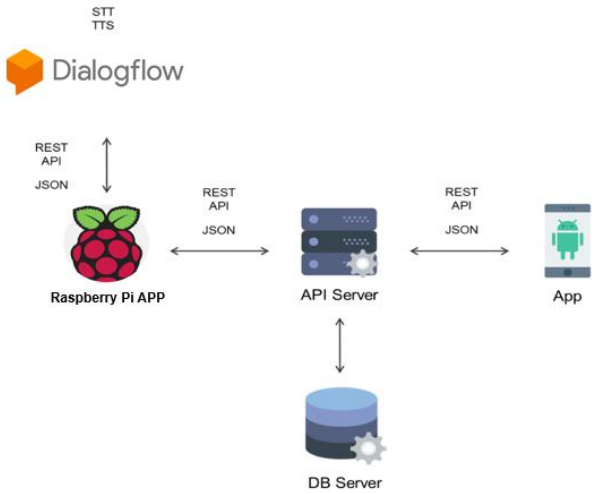

Fig. 2. Architecture of the software

The hardware of the AI speaker-based reminder system consists of an AI speaker and a smartphone that combines Google Assistant on Raspberry Pi. AI speakers enable interaction with the users through their voice, and motion sensors detect movements around them. The reminder app installed on smartphones sets up and manages what will be uttered through AI speakers. In addition, by using Bluetooth built in smartphones, it can determine more accurately whether the user is at home or not.

The reminder system's software consists of API server, database, and application for conversation. As for requests from AI speakers and smartphone apps, API server accesses to the database, enabling operations such as inquiry, insertion, deletion, and updates. Database is used to store sensor values, schedules, and commute time, etc. The chat application receives the user's voice through the microphone and sends it to Dialogflow. Dialogflow provides STT (Speech to Text) and TTS(Text to Speech) to enable two-way conversion of speech and text. For text-type requests converted through STT, Dialogflow responds based on pre-learned scenarios. Dialogflow is a chatbot builder, so it provides a text-type response. Therefore, AI speaker's utterance is implemented by converting them into speech through TTS and having them output to the speaker. Finally, the smartphone app can interact with the user along with the chat application, and provides the function to reminder the user.

There are two preconditions for using reminder services through AI speakers.

First, the motion sensors on AI speakers detect movements around them. When movements are detected, it is determined that the user is within the range where the AI speaker can be used.

Second, the BlueZ library is installed on the Raspberry Pi, the platform for AI speakers, to detect nearby Bluetooth devices. At this time, if it matches the address of the Bluetooth MAC registered in user's smartphone, it is determined that the AI speaker is within the range of use.

If both conditions are met, the schedule can be stored on the smartphone app by voice through the AI speaker, and the stored schedule can be notified by voice through the AI speaker.

Event types deduced from the sensor data are updated in the database and used as triggers for the operation of the AI speaker.

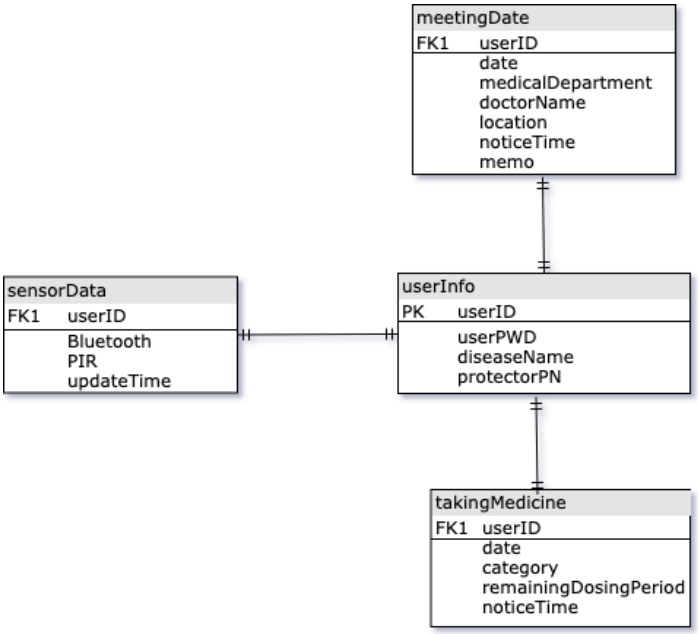

Fig. 3. Schema of the reminder system

Figure 3 shows the database schema for the reminder system. SQL, one of Google Cloud services is used as DBSMS software, and the application accesses the database through API servers to look up or store data.

The userInfo table is for storing user's information. It stores user's ID, password, disease, and guardian's telephone number. All tables are referenced by the userID of userInfo.

The meetingDate table is for storing consultation/ check-up schedules. It includes columns for the date of consultation/ check-up, medical department, doctor's name, the location of the medical institution, the reminder time, and special notes.

The sensorData table is for storing sensor values that determine whether a user can use AI speakers. The Bluetooth is the RSSI

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value of smartphone bluetooth. The PIR is a column that stores 0 or 1 by detecting movements. The UpdataTime is a column for checking the time when sensor values are updated.

The takingMedicine table is a drug-related table that includes the date/ time of taking medicine, the type of medicine, the remaining dosing periods, and setting the reminder time.

In order for API server to provide users with appropriate information, AI speakers and smartphone apps must exchange information. The reminder system proposed in this paper manages data using the database, and its access to the database is made through API provided by API server. Smartphone apps cannot directly access to the database, and even if its access is possible, the data is accessed through API server for security.

AI speakers interact directly with the user, along with the smartphone apps. AI speakers interact with the user through his voice. AI speakers convert the user's voice into text via STT, and then perform natural language processing using NLP, making it easier to grasp the user's intentions. And then, according to the user's intention, AI speakers provide appropriate responses such as schedule setting/ modifying/ deleting or checking a notification.

Smartphone apps receive the schedule from the API server linked with the database and make it visible on the screen, and allow the user to directly input the schedule through TimePicker or DatePicker. They also provide a push notification at the time which was input in the reminder system, and provide the weather information of the day when there is a schedule to go for a consultation/ check-up by using RSS (Rich Site Summary) of KMA (Korea Meteorological Administration). Figure 4 shows the smartphone app's UI related these functions.

In addition, if you register your dosing time, you will be notified by push messages at that time as shown in Figure 4.

Fig. 4. Schedule registration and reminder time setting by using smartphone application and AI speaker

IV. VERIFICATION OF SERVICE SCENARIOS OF AI SPEAKER-BASED REMINDER SYSTEM

The user can set the reminder system for the doing time, consultation/ check-up schedule, and the day's weather information using the smartphone app as shown in Fig 5.

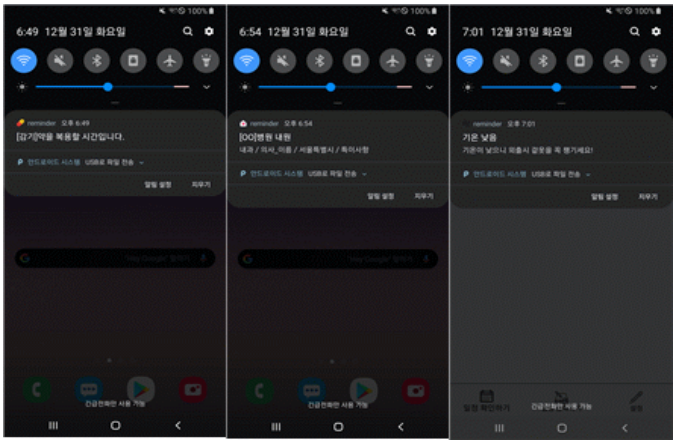

Fig. 5. Push notifications for schedule and weather information

In order to determine whether the user is inside or outside his house, sensors detect movements in his house and compare whether the Bluetooth module around him has the same address as it of the prestored user's smartphone Bluetooth module.

When movements are detected at home and the user's smartphone stored in advance is recognized through Bluetooth, the user is determined to be at home, and the AI speaker is activated to register the schedule and to receive the notification. For example, if the time is 7:00 am, the smartphone app will provide you with precautions regarding the weather, as shown on the third picture in Fig 5, making it helpful not to worsen your health because of the weather. After checking the reminder system, it will be notified through the AI speaker when the reminder time of the registered schedule arrives. In case of consultation/ check-up schedule, it also provides information on the weather.

If no movement is detected within the home or if the user's smartphone cannot be found around through Bluetooth, the user is determined to be outside and the notification can be available through the smartphone app. Just like when the user is at home, it informs the user of the weather notice at 7:00 am, and provides information about the weather when the schedule is about consultation/ check-up.

Figure 6 shows the operation procedure of the AI speaker-based reminder system proposed in this paper.

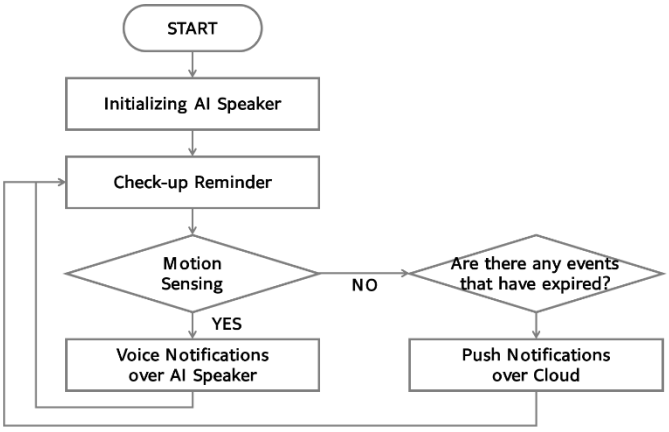

Fig. 6. Reminder System's Notification Flow Diagram

VI. CONCLUSION

Medication treatment, which accounts for the largest proportion of the disease treatment, should be taken at the right time in order to maximize the effectiveness of treatment.

In this paper, we propose a service that uses the digital media such as applications and AI speakers to provide detailed information about the dosing cycle and the check-up cycle. This service enables the user to register the type of disease, the dosing time and the medical check-up date using applications and AI speakers, and enables the user know them by using AI speakers or applications depending on whether the user is at home or not. It uses not only applications but also AI speakers. This service, which register the dosing time and the check-up schedule by speaking to AI speakers in advance, not only increases the effectiveness of delivering the registered schedules, which are important factor of health, but also facilitates the interaction between the user and smartphone applications. In addition, all the information of the system can be recorded in the database, so it is expected to be the means to facilitate the treatment by transferring the data to a medical institution.

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REFERENCES

[1] TD Sequist, AM Zaslavsky, R Marshall, RH Fletcher, JZ Ayanian, Patient and physician reminders to promote colorectal cancer screening: a randomized controlled trial, Archives of internal medicine. 2009;169(4): 364-371

[2] MyTherapy, https://www.mytherapyapp.com/ko

[3] Medisafe, https://www.medisafeapp.com/

[4] Mr. Pillster, http://mrpillster.whisperarts.com/