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## Measurements, Medications, and Symptoms Logging Using a Virtual Assistant

Aayush Kumar

Adriana Moisil

Yariv Adan

Andre Elisseeff

Matt Stokes

*See next page for additional authors*

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**Inventor(s)**

Aayush Kumar, Adriana Moisi, Yariv Adan, Andre Elisseff, Matt Stokes, Sandro Montanari, Alexandru Grigori, Myroslava Dzikovska, Alexander Trewby, and Joe Swainston

## **Measurements, medications, and symptoms logging using a virtual assistant**

### **ABSTRACT**

This disclosure describes virtual assistant based techniques that, with user permission, log medications, symptoms, and measures of health. The techniques offer an easy mechanism for users to document their symptoms, vital signs, health data, etc. For example, a user simply speaks out their symptoms to their virtual assistant to create a log. Vital signs are automatically logged by the virtual assistant (with user permission) using, e.g., sensors and mobile/wearable devices. The techniques enable users to develop a personal health journal that frictionlessly logs activity, sleep, nutrition, heart rate, etc. When enabled, the virtual assistant reminds users of medications to be taken and also prevents accidental doubling of dosages. The automatically generated and curated personal health journal enables users to focus on a healthier lifestyle, provides valuable clues to pathologies, enables querying of health history, helps understand trends, and helps caregivers and doctors better deliver healthcare. The techniques are implemented with specific user permissions and in compliance with regulations related to health information.

### **KEYWORDS**

- health parameters
- vital signs
- health journal
- virtual assistant
- medical log
- health log

### **BACKGROUND**

Logging one's health using a personal health journal has many benefits, e.g., it helps focus user attention towards a healthier lifestyle, provides valuable clues to pathologies and lifestyle-induced conditions, enables querying of health history, helps understand trends, helps caregivers and doctors better deliver healthcare, etc. However, maintaining a health journal is currently a mostly-manual, tedious, and time-consuming task. Indeed, many who start writing health journals give up within days or weeks into the effort.

## DESCRIPTION

This disclosure describes virtual assistant based techniques that, with user permission, log medications, symptoms, and measures of health. The techniques offer an easy mechanism for users to document their symptoms, vital signs, health data, etc. For example, a user simply speaks out their symptoms to their virtual assistant to create a log. Vital signs are automatically logged by the virtual assistant (with user permission) using, e.g., sensors and mobile/wearable devices. The techniques enable users to develop a personal health journal that frictionlessly logs activity, sleep, nutrition, heart rate, etc. When enabled, the virtual assistant reminds users of medications to be taken and also prevents accidental doubling of dosages.

### **Logging of health measures**

The virtual assistant captures (with user permission) the user's weight (in kilograms or pounds, per user preference), blood pressure (in mmHg), blood glucose (in mmol/l or mg/dl), body temperature (in °C or °F), etc. when the user orally invokes the virtual assistant and describes one of these measurements to the virtual assistant. If the user does not specify the units, the units are inferred based upon the following factors.

- The number itself: in the case of body temperature and blood glucose, there is no overlap between the two units.

- Past inputs: The user’s weight on a given day is within a relatively narrow range of their weight on the previous day.
- Locale: In the US, weights are measured in pounds and temperature in Fahrenheit. In Europe, weights are measured in kilograms and temperature in Celsius.

Example: logging of health measures

Example oral descriptions that can be received by the virtual assistant are as follows.

- “My weight is 150.”
- “Take down my blood pressure,” the virtual assistant response to which can be: “Sure, what’s your blood pressure right now?”

Upon capturing an oral description of a health measure, the virtual assistant provides a confirmation, along with an optional encouragement message. The encouragement message is utilitarian and information-based and conveys no opinion. An example confirmation/encouragement message is:

- “75 kg, in your health journal now. You’re doing a good job of logging your weight — that’s 5 in a row!”

Example: querying of health measures

The user can query the virtual assistant over health measurements, examples of which follow.

- “How am I doing on my blood pressure?”
- “What is my weight?”
- “Show my weight chart.”

The virtual assistant response to this can be: “You told me on Monday that your weight was 73 kg.”

The virtual assistant immediately answers simple queries. For more complex interactions, e.g., a user request to overlay graphs of histories of symptoms data and vital signs data, the virtual assistant links to fitness applications or other resources as necessary. The virtual assistant can answer queries based on information available in a knowledge base. If the patient logs multiple symptoms, medications, or measurements, the virtual assistant provides answers for any of these.

### **Logging of symptoms**

If the user permits, the virtual assistant logs symptoms relating to pain, stress, mood, or custom categories created by the user. The virtual assistant can accept as input longer natural language explanations that refer to the symptom indirectly and map such explanations to symptoms. For example, a user's statement "I have runny motions" is mapped to diarrhea. Depending on the symptom type, the symptom is logged on an analog scale (0-10), an ordinal/categorical scale, or a continuous scale. In addition, the user can add notes or images, or specify a location, duration, intensity, frequency, etc. for a symptom.

For example, the user can specify "left leg" as the location of pain, or "forehead, sinus, back-of-head" as the location of a headache. Mood can be logged using a 0-10 analog scale, using emojis or smiley faces, etc. A user interface can capture and log mood in the form of a relatively large set of emotions.

### **Example: logging of symptoms**

An example conversation comprising oral descriptions of symptoms is as follows.

**User:** "Record my pain".

**Virtual assistant:** "Sorry to hear that, where exactly are you feeling pain".

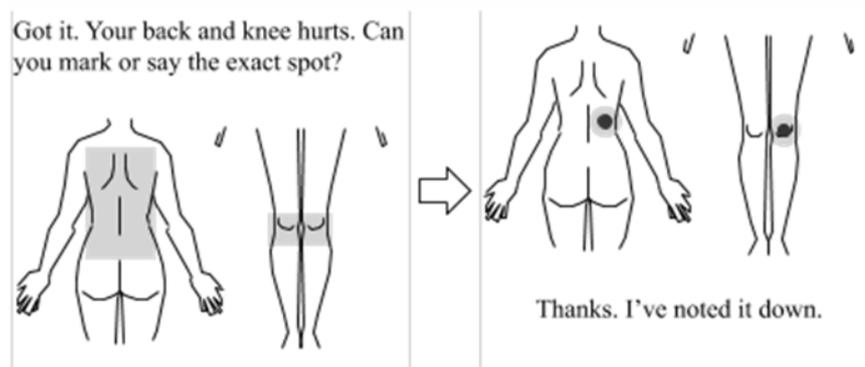
**U:** "I have pain in my left knee".

**VA:** “Sorry to hear that, how bad is it on a scale of 1 to 10, where 10 is really bad?”

**U:** “8”.

**VA:** “Yesterday you said it was 9, so it has improved somewhat?”

To localize a pain symptom, the virtual assistant shows sketches of the human body on a display and asks the user to select the location of the pain, as illustrated in Fig. 1.



**Fig. 1: An example of a conversation between a user and a virtual assistant that specifies the location of pain**

When the user is already logging an existing symptom or pain, the virtual assistant

- interprets conversations based on previously logged symptoms, e.g., does not ask again about the location of the pain/headache or the type of symptom again; and
- informs the user of the intensity of the symptom they logged the previous time, so that they can compare it to how they are feeling at the moment.

#### Example: querying of symptoms

The user can query the virtual assistant over logged symptoms. Example queries are shown below:

- “Show me my pain chart.”
- “What did I tell you about my last pain entry?”

## **Logging of medications**

The virtual assistant logs (with user permission) adherence to prescriptions from the user's doctor. With appropriate permissions, it surfaces insights into the relationship between medication regimen and health restoration by comparing usage with data such as activity, symptoms, or resting heart rate. The virtual assistant reminds users appropriately to take their medications. It makes it easy and convenient for users to ask about and log their medications.

The virtual assistant can handle several scenarios, as follows:

- User explicitly mentions the name of the medication that they took. For example, the user may say, "I took my medication X this morning". If the user is logging their medication in another application, then the assistant confirms (with user permission) with the other application that the medication is taken. When the virtual assistant next reminds the user, it references the previous taking of medication as marked in the other application: "Got it, medication X. You already marked the dose as taken at 11 am. Did you take another one after that?" A deep link to the relevant section of other application is provided. If the user is not logging medications in another application, the virtual assistant records that they took the medication and asks if this is a medication to be taken regularly: "Got it, I've taken a note. Is this a medication you have to take regularly?" The name of the medication, as stated by the user, can either be a brand name or a generic name; the virtual assistant is cognizant that either name refers to the same medication.
- User mentions that they took (some) medications. For example, the user may say, "I just took my medication", "I just took my evening medicines", etc. In this case, the virtual assistant reconfirms the list of medications that the user took: "Got it, so you took medication X, medication Y, and medication Z. Is that right?" If the user is logging just

one medication, the virtual assistant may not explicitly ask for a reconfirmation of medicines taken: “Great, I note that you took your medication X”.

- User refers to medications by nicknames. Some medication names are long and complex, and users may refer to the medication they are taking based on the physical attributes or some other nickname. In this case, the user can set a nickname for the medication, and refer to the medication by the nickname: “I just took the red pill.”
- User refers to medications by their functional attributes. Some users identify the medication they take based on function. For example, they may say, “I took my stomach ache pill”. In this case, the virtual assistant determines the medication taken by the user by determining the functions of the medications on the user’s logged list of medications.

#### Example conversations about medications

- Questions about medications.

**User:** “What medications do I need to take today?”

**Virtual assistant:** “You told me that you have to take your medication X at 12 noon today and medication Z at 6 PM”

- Logging medications.

**User:** “I took my medication X”

**Virtual assistant:** “Thanks. I logged that”

- Reminders about medications.

**Virtual assistant:** “You told me to remind you to take your medication X at 1 PM today”

#### Example: querying about medications

The user can query the virtual assistant over medications, as the following examples illustrate.

- “What medications do I have to take (today)?”

- “When should I take medication X next?”
- “Have I already taken medication X for today?”

### **Notifications**

The virtual assistant sends periodic, e.g., daily, notifications reminding the user to measure and log health parameters, report symptoms, and take medications, if the user hasn't already done so for the day. For example, if the user is running a temperature, the virtual assistant sends periodic notifications until the temperature is back to normal. For example, a notification can include a title (e.g., “Time to log your weight”, “How is your knee ache”, “Take medication Z at noon”), a text-box comprising an educational or motivational message (e.g., “regular logging greatly helps you understand your health”), action buttons (e.g., “log now”, “remind me later”, “dismiss”), etc. The notifications can be followed by a message that recognizes the completion of a goal (e.g., “Completed five logs in a row”, “Completed twenty logs this month”, etc.) or motivates action towards the goal. Where relevant, the user is automatically notified to log their health measure once they have made an initial log. For instance, if the user reports their weight, the virtual assistant from the following day issues reminders to measure the user's weight, unless they already have, in which case the notification is not sent. As another example, if the user reports a hurt knee, the virtual assistant issues from the following day reminders to report on the status of the knee, unless they already have, in which case the notification is not sent. The notification is sent until the symptom disappears. The user can turn off these notifications at any time.

### **Suggestions**

Towards the end of a conversation, the virtual assistant provides suggestions, examples of which are as follows.

- Continue conversation: “My weight graph”, “My medications chart”, “My temperature graph”, “Side-effects of this medication”, “Add notes”, “Add photo”, “Log symptom duration”, “Add medication”, etc.
- Delete or undo last measurement.
- Log another measurement, symptom, or medication of the same type.
- Offer discovery into other related features: “Log blood pressure”, “Log my mood”, “Log my medications”, “Log blood glucose”, etc.
- Deep link to related applications.
- View graph or log of medications, measurements, or symptoms.
- Nudge the user towards systematic logging, e.g., by creating a goal.

The techniques described herein are implemented with specific user permissions and in compliance with regulations related to health information. Storage of health data is performed in a secure manner and access to such data is restricted. Health data is stored for specific time periods and is not retained if the user discontinues use of the techniques. Users are provided with clear information that while the virtual assistant can assist with keeping a log and provide reminders, the users are to consult a qualified health practitioner for any health complaints.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user’s social network, social actions or activities, profession, a user’s preferences, or a user’s current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user’s identity may be treated so that no personally identifiable information can

be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

## CONCLUSION

This disclosure describes virtual assistant based techniques that, with user permission, log medications, symptoms, and measures of health. The techniques offer an easy mechanism for users to document their symptoms, vital signs, health data, etc. For example, a user simply speaks out their symptoms to their virtual assistant to create a log. Vital signs are automatically logged by the virtual assistant (with user permission) using, e.g., sensors and mobile/wearable devices. The techniques enable users to develop a personal health journal that frictionlessly logs activity, sleep, nutrition, heart rate, etc. When enabled, the virtual assistant reminds users of medications to be taken and also prevents accidental doubling of dosages. The automatically generated and curated personal health journal enables users to focus on a healthier lifestyle, provides valuable clues to pathologies, enables querying of health history, helps understand trends, and helps caregivers and doctors better deliver healthcare. The techniques are implemented with specific user permissions and in compliance with regulations related to health information.