



Development of a voice interface application for self-management with type 2 diabetic elderly patients



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THE PROBLEM

- Patient self-management of type 2 diabetes mellitus (T2DM) is crucial to reducing its chronic progression and serious future health complications.
- Due to the comorbidity of T2DM and depression, constructing a routine screening protocol is necessary for healthy coping [1].
- The current state of the art mostly assists patients through mobile applications. For the elderly, these mobile apps are marginally effective and even frustrating to use [2].

OUR SOLUTION

- This project proposes Healthy Coping with Diabetes, a **Google Home assistant** application that acts as an innovative intervention strategy to assist elderly patients with self-management of T2DM.
- Emphasizes the use of a **voice interface** rather than a strictly tactile one in order to provide older patients with the opportunity to easily engage in practical application of clinical care management.
- Framework combines the **voice interface of Google Home** for hosting the chat bot and a **web interface for data visualization** in order to reduce the burden of monitoring diabetic consequences for the user.

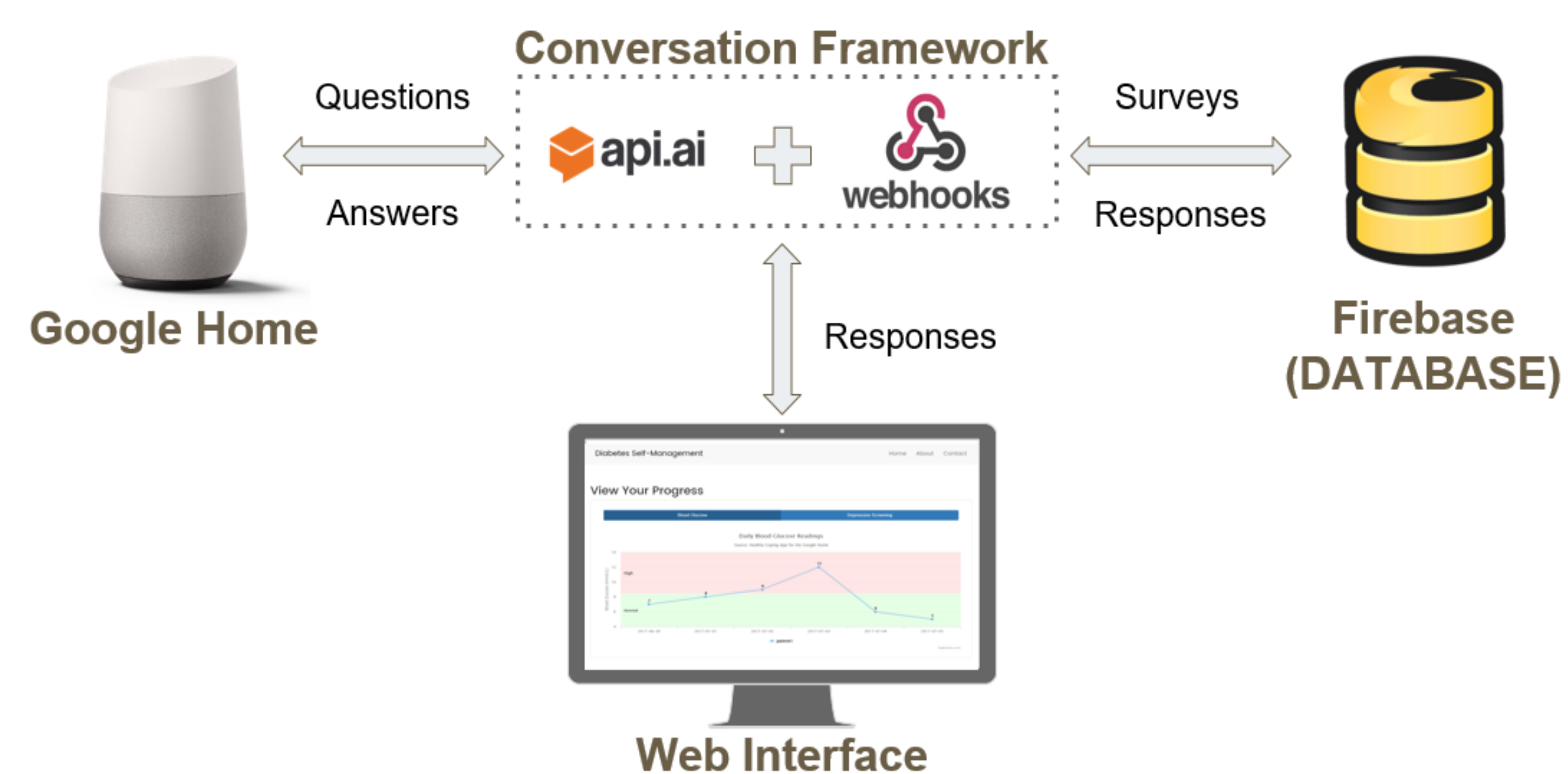


Figure 1. Illustration of the entire application framework, showing the directional organization of input and output data.

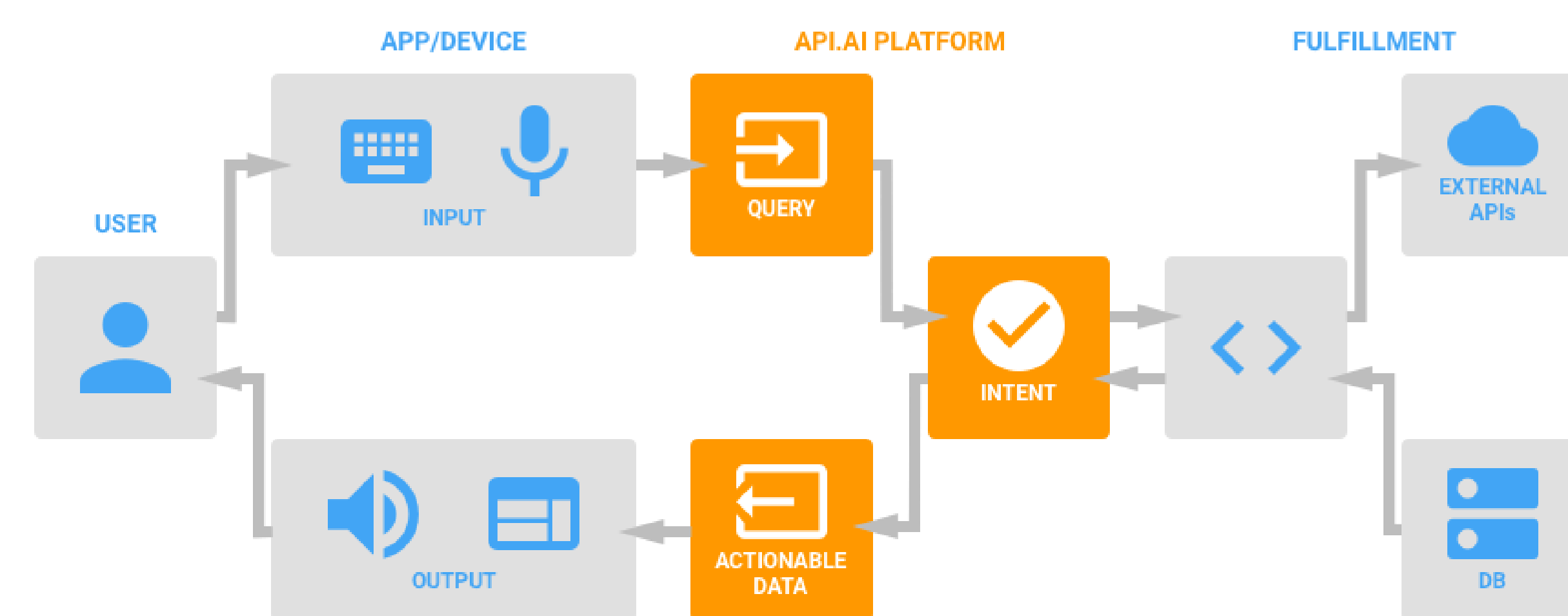
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APPLICATION FRAMEWORK

GOOGLE HOME & API.AI

- Conversational agent
 - A Natural Language Understanding module that transforms natural user requests into actionable data
 - Transformation occurs when an utterance given by the user matches one of the intents inside the application agent
- Intents
 - Main intents correspond to AADE DSM guidelines (ie. Healthy coping, monitoring, healthy eating, medication, etc.)
- Entities
 - Represent parameter values from natural language inputs
- Webhook
 - A REST API that handles routing and business logic of intents

See the flow diagram below [3]:



WEB INTERFACE

- Serves as data visualization component
- Allows for patients to track their responses on interactive graphs and charts without having to manage their data themselves.
- Allows for physicians to monitor a patient's status without in-person appointments

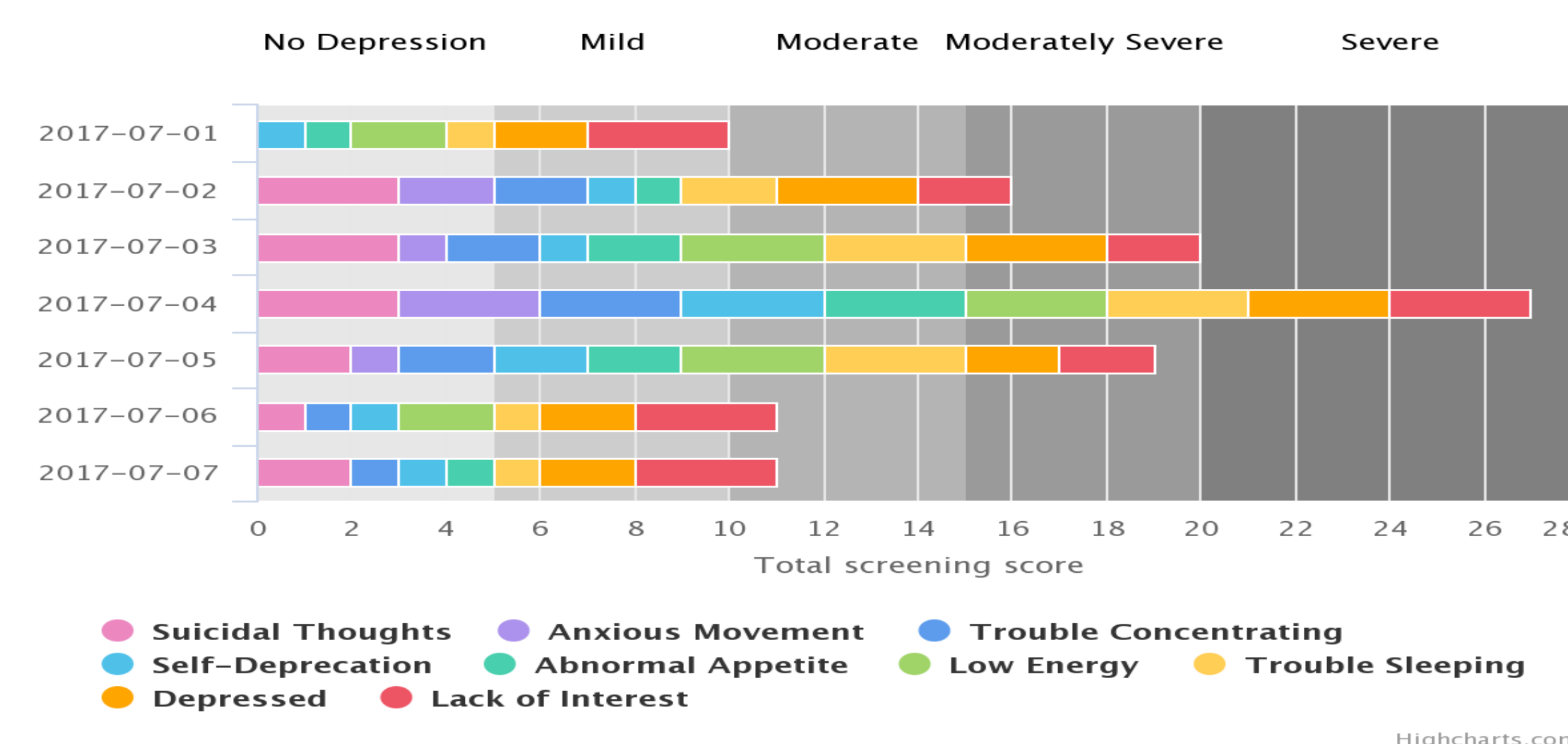
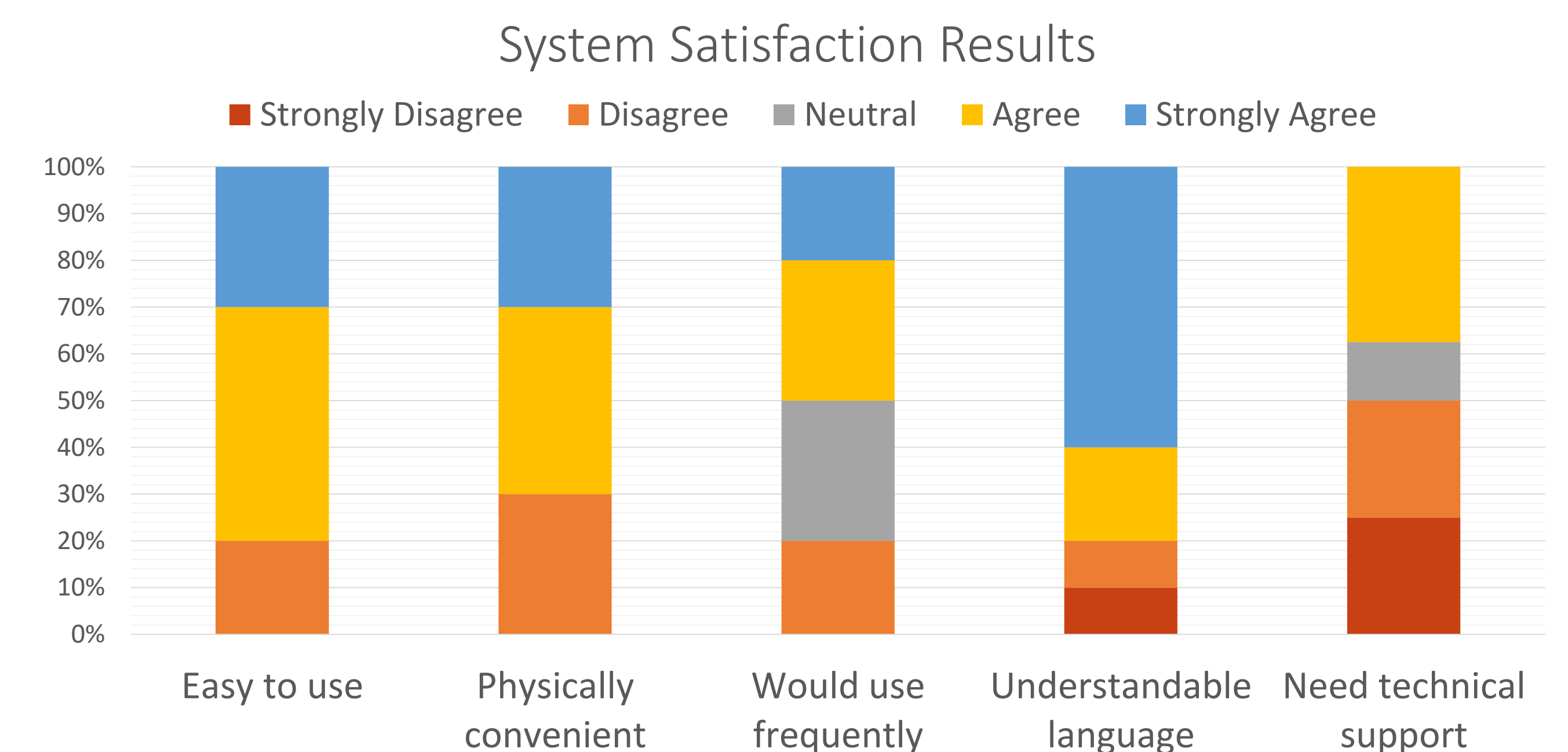


Figure 2. Sample data visualization for a patient's depression level, represented by user data that has been extracted from answers to the depression screening survey given by the Healthy Coping agent.

RESULTS

- Feedback from experts in elder care:
 - Speed of Google Home commands
 - Accommodations for hearing and speech disabilities
- 80% prefer voice interface, 10% prefer the tactile interface, and 10% are neutral
- Usability metrics of the application for satisfaction



CONCLUSION

- By utilizing the Google Home and API.AI platform, we are able to deploy the Healthy Coping application on a voice interface and **eliminate the struggles that are associated with strictly tactile screens.**
- By combining the functionality of the conversational agent and the simple web interface, we allow for a **less cumbersome** way for geriatric T2DM patients to effectively adhere to DSM guidelines.
- Based on our test results, our application improves upon the current state of the art by **increasing user satisfaction and convenience.**

REFERENCES

[1] W. J. Katon, The Comorbidity of Diabetes Mellitus and Depression, *The American Journal of Medicine*, vol. 121, no. 11, Nov. 2008.

[2] A. Rao, P. Hou, T. Golnik, J. Flaherty, and S. Vu, Evolution of Data Management Tools for Managing Self-Monitoring of Blood Glucose Results: A Survey of iPhone Applications, *Journal of Diabetes Science and Technology*, vol. 4, no. 4, pp. 949-957, Jul. 2010.

[3] Agents on API.AI, API.AI. [Online]. Available: <https://api.ai/docs/agents>. [Accessed: 15-Jun-2017].