

Voice Enabled Smart Home Assistant for Elderly People

M. Madhu Rani¹, S. Sreesubha², K. Tamilarasi³, S. Valli Sneha⁴

¹Assistant Professor, Department of Information Technology, Rajalakshmi Engineering College, Chennai, India

²Assistant Professor (SS), Department of Information Technology, Rajalakshmi Engineering College, Chennai, India

³Assistant Professor (SG), Department of Information Technology, Rajalakshmi Engineering College, Chennai, India

⁴Assistant Professor, Department of Information Technology, Rajalakshmi Engineering College, Chennai, India

Abstract: People tend to keep things in one place and forget the location of those items later. It could be a watch or spectacles or anything else. Especially elderly people find it difficult to remember things and find them when needed. Another major concern is the people with Alzheimer's disease. They tend to forget things frequently. This paper focuses on developing a Voice enabled Smart Home Assistant that will help find items in a home for elderly people and those with Alzheimer's disease and also be used by people who often forget where they keep their things as well as large organizations to manage complex inventory, without the friction and multiple steps of keeping inventory updated. And also support natural and secure interaction using voice recognition. This paper will be relevant to society, as users will be able to communicate with the Smart Home Assistant in a natural way and security will also be ensured as an unauthorized users is not having the rights to access the objects. The Voice enabled Smart Home Assistant will employ natural language processing techniques to understand the user's request to identify the location of the object and report it to the user. This paper will be implemented using Amazon Alexa which is a cloud-based voice service and the users can be accessed through the Amazon Echo device.

Keywords: Alexa, Smart Home Assistant, Amazon Echo, Amazon Web Service

1. Introduction

Earlier, businesspeople talked about checking the calendar on their personal digital assistant (PDA). PDAs were the perfect predecessors for the virtual organizers of today because they helped set the foundation for a dependence on digital scheduling. Today, virtual personal assistants, which can essentially organize large parts of our lives, are a standard feature on smartphones worldwide. Amazon Alexa is one such virtual personal assistant.

Alexa is Amazon's cloud-based voice service available on tens of millions of devices from Amazon and third-party device manufacturers. With Alexa, natural voice experiences can be built that offer customers a more intuitive way to interact with the technology they use every day. It consists of a collection of tools, APIs, reference solutions, and documentation to help build an Alexa skill.

The personal assistant 'Alexa' is used for the interaction module with the users, as it is more feasible and supports natural language processing and also helps users interact with the device naturally and use the service in an efficient way. This proposed system is the natural language processing implementation which enables the natural interaction between the user and the personal assistant. The users can store the gadgets and the location of their places in the software named alexa which can be later retrieved anytime by the users.

This paper is implemented using the virtual assistant named "Amazon Alexa", which is integrated with a device named "Echo". Alexa is Amazon's cloud-based voice service available on tens of millions of devices from Amazon and third-party device manufacturers. With Alexa, natural voice

experiences can be built that offer users a more intuitive way to interact with the technology they use every day. Alexa voice capabilities are integrated into their own connected products by using the Amazon Voice Service (AVS), a cloud-based service that provides APIs to interface with Alexa. AVS provides cloud-based Automatic Speech Recognition (ASR) and Natural Language Processing (NLU).

A dynamo database which is a service of Amazon Web Services will be used to store the items and their locations. The users can add or remove items from the database. The database will be updated periodically based on the inputs received from the Image processing module as well as voice interaction with the users. The location of the gadget will be retrieved from the database and the response will be announced to the user.

2. Objectives

- To develop a Voice enabled Smart Home Assistant that will help people find items/gadgets in a home environment using Natural Language processing techniques in English language.
- To enable security for the users by the means of voice recognition.
- To perform image recognition to locate gadgets of interest.

3. Literature Survey

Peter Imrie , Peter M.Bednar, "Virtual Personal Assistant," The 10th conference of The Italian Chapter of AIS, Italy, 2013, engages the ability to communicate

socially through natural language processing, holding and analyzing data within the context of the user

David Isbitski, "Enabling New Voice Experiences with Amazon Alexa and AWS Lambda," AWS SUMMIT, APRIL 2016, Each intent consists of two fields. The intent field gives the name of the intent. The slots field lists the slots associated with that intent. The mappings between intents and the typical utterances that invoke those intents are provided in a tab-separated text document of sample utterances.

Kosuke Tsujino, Shinya Lizuka, Yusuke Nakashima, Yoshinori Isoda, "Speech Recognition and Spoken Language Understanding for Mobile Personal Assistants: a Case Study of 'Shabette Concier'," IEEE 14th International Conference on Mobile Data Management, 3rd June 2013, Advancement in statistical automatic speech recognition (ASR) and spoken language understanding (SLU) technologies.

Joao Santos, Joel J.P.C. Rodrigues, Joao Casal, Kashif Saleem, Victor Denisov, "Intelligent Personal Assistants Based on Internet of Things Approaches," IEEE Systems Journal, Vol. 12, Issue 2, pp:1793-1802, June 2018, IPAs can improve the assistance they offer to users by collecting information autonomously from objects that are available in the surrounding environment.

Hyunji Chung, Sangjin Lee, "Intelligent Virtual Assistant knows your Life," Computers and Society, Vol. 42, 2017, A large amount of behavioral traces that include user's voice activity history with detailed descriptions can be stored in the remote servers within the IVA ecosystem.

Poonam Patil S1, Rudrappa B Gujanatti2, "Alexa on Amazon Ecosystem," International Research Journal of Engineering and Technology, Volume: 04 Issue: 08 | Aug - 2017, With the popularity of speech-driven Artificial Intelligent (AI) assistants like Google Home, Apple's Siri, Amazon Echo, the ability to not just listen the question but also understand and reply in seconds has brought illusion into reality. Pi on Amazon Ecosystem

Abhay Dekate, Chaitanya Kulkarni, Rohan Killedar, "Study of Voice Controlled Personal Assistant Device," International Journal of Computer Trends and Technology (IJCTT), Vol. 42, NO. 1, December 2016, Model developed keeps learning the sequence of questions asked to it - which it remembers for the future.

Veton Kepuska, "Comparing Speech Recognition Systems (Microsoft API, Google API and CMU Sphinx)," International Journal of Engineering Research and Application, ISSN : 2248-9622, Vol. 07, Issue 3, (Part-2), pp: 20-24, March 2017, On an average, all the existing systems have WER (Word Error Rate) of more than 30%. Among them, Google API and Amazon Alexa have the least WER of 9%.

Prajyot Mane, Shubham Sonone, Nachiket Gaikwad, Jyoti Ramteke, "Smart Personal Assistant using Machine Learning," International Conference on Energy,

Communication, Data Analytics and Soft Computing (ICECDS), 2nd August, Model continuously improves its behavior based on previous experiences through learning mechanism.

Soumya Priyadarsini Panda, "Automated Speech Recognition System in Advancement of Human-Computer Interaction," Proceedings of the IEEE 2017 International Conference on Computing Methodologies and Communication (ICCMC), Speech recognition deals with understanding the context or the meaning of the human generated speech by a machine.

Hyunji Chung, Michaela Iorga, Jeffrey Voas, Sangjin Lee, "Alexa, Can I Trust You?," Computer, Vol.50, Issue 9, pp:100-104, 2017, Several recent incidents highlight significant security and privacy risks associated with intelligent virtual assistants (IVAs). Using speaker dependent voice recognition systems can improve the security

Abdulaziz Alhadlaq, Jun Tang, Marwan Almaymoni, Aleksandra Korolova, "Privacy in the Amazon Alexa Skills Ecosystem" in Proceedings of Network and Distributed System Security Symposium (NDSS), 2017, Although users interact with Skills using voice commands, the audio is not made accessible to the developers. Although users interact with Skills using voice commands, the audio is not made accessible to the developers.

Gabriela Czibula, Adriana-Mihaela Guran, Istvan Gergely Czibula and Grigoreta Sofia Cojocar, "IPA - An Intelligent Personal Assistant Agent For Task Performance Support," in Proceedings of the ICIC 2007, 2007, pp. 1357-1367, A solution to deal with this challenge is to build a personal assistant agent capable to discover the user's habits, abilities, preferences, and goals, ever more accurately anticipating the user's intentions.

Deepak Kumar, Riccardo Paccagnella, Paul Murley, Eric Hennenfent, "Skill Squatting Attacks on Amazon Alexa," 27th USENIX Security Symposium August 15-17, 2018, An attacker can leverage systematic errors in Amazon Alexa speech-recognition to cause undue harm to users.

Seema Rawat, Parv Gupta, Praveen kumar "Digital Life Assistant using Automated Speech Recognition" International Conference on Innovative Applications of Computational Intelligence on Power, Energy and Controls with their Impact on Humanity (CIPECH14) 28 & 29 November 2014, A speaker dependent system is one which operates upon the voice command of a single person.

4. Proposed System

Voice enabled Personal Assistant as shown in 1 will employ natural language processing techniques to understand the user's request and then use image recognition to identify the location of the object and report it to the user. This paper will be implemented using Amazon Alexa which is a cloud-based voice service and the users can be accessed through the Amazon Echo device.

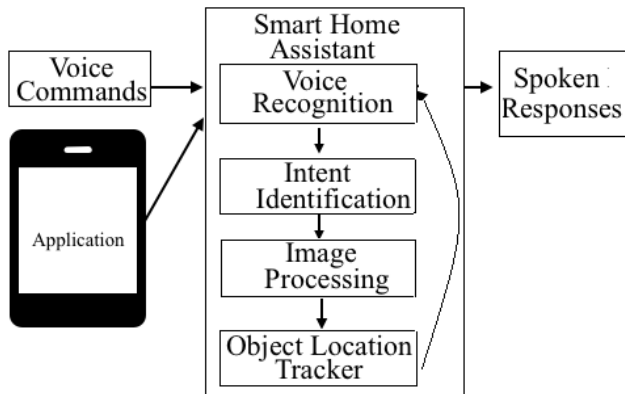


Figure 1: Architecture Diagram of the proposed system

The intents for object storing and retrieving can be used to add and delete rows in the dynamo database. The Endpoint can be used to link the front end and the back end of the application skill.

The backend code is written in javascript and is linked to the corresponding intent through the endpoint. The lambda is used as the source for the backend code. The code can be written in the lambda console or it can be written from a local machine and can be uploaded to the application skill.

5. Results and Discussions

- Unlike other Alexa skills, this skill understands natural language more efficiently as it uses speech recognition to convert speech to text.
- This skill identifies similar words related to the objects stored and thus can identify objects even when the actual name of the object is not given as the input from users.
- Time has been added to the database at the time of inserting a new object. So, when the user requests the skill to locate the place of an item, the skill responds back to the user with the location along with the last accessed time and date. This feature is highly beneficial as it helps users keep track of their items.

An alexa skill has been developed and published in the Alexa skills store and is accessible to the users.

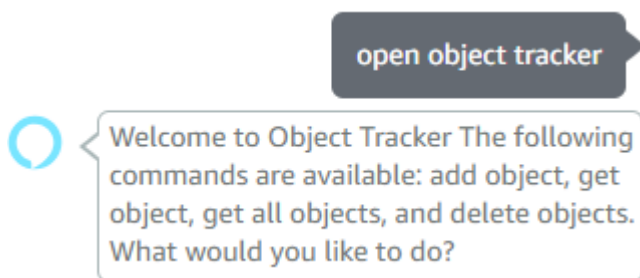


Figure 2: Execution of Launch Request

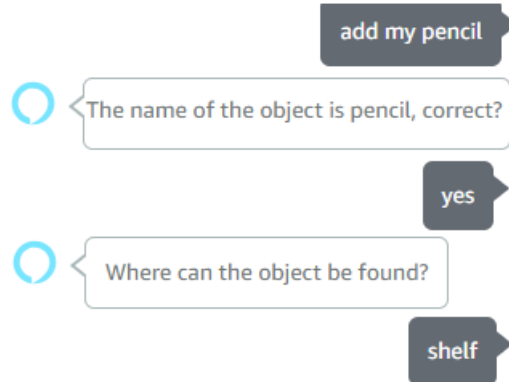


Figure 3: Execution of Add Gadget Intent

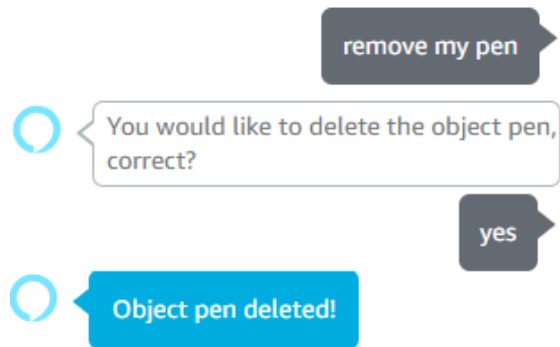


Figure 4: Execution of Delete Gadget Intent

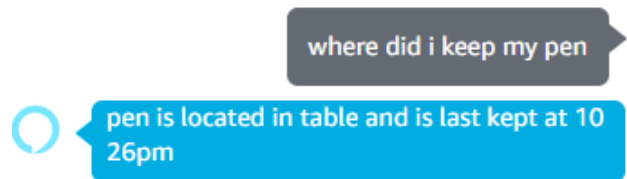


Figure 5: Execution of Get Gadget Intent

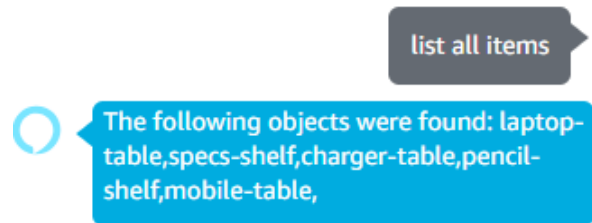


Figure 6: Execution of Get All Gadgets Intent

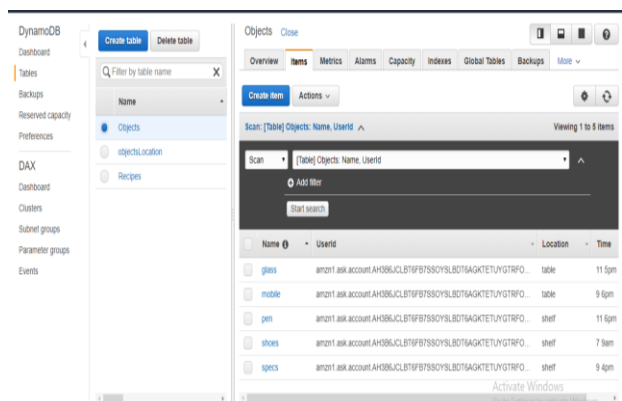


Figure 7: Database– Storage of Data about Gadgets

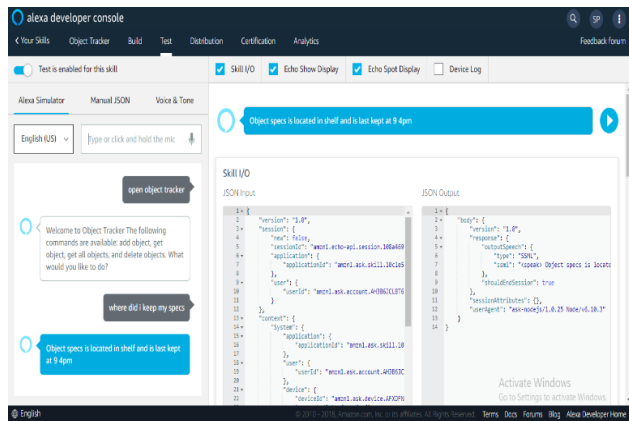


Figure 8: Execution the gadget recognizer skill

References

- [1] Abdulaziz Alhadlaq, Jun Tang, Marwan Almaymoni, Aleksandra Korolova, "Privacy in the Amazon Alexa Skills Ecosystem" Proceedings of Network and Distributed System Security Symposium (NDSS), 2017, pp. 317–327.
- [2] Abhay Dekate, Chaitanya Kulkarni, Rohan Killedar, "Study of Voice Controlled Personal Assistant Device," International Journal of Computer Trends and Technology(IJCTT),Vol. 42, NO. 1, December 2016, pp. 52–63.
- [3] David Isbitski, "Enabling New Voice Experiences with Amazon Alexa and AWS Lambda," AWS SUMMIT, APRIL 2016 in Sanfrancisco, pp. 01–15.
- [4] Deepak Kumar, Riccardo Paccagnella, Paul Murley, Eric Hennenfent, "Skill Squatting Attacks on Amazon Alexa"27th USENIX Security Symposium, August 15–17, 2018, pp. 22–36.
- [5] Gabriela Czibula, Adriana-Mihaela Guran, Istvan Gergely Czibula and Grigoreta Sofia Cojocar, "IPA - An Intelligent Personal Assistant Agent For Task Performance Support" Proceedings of the ICIC 2007, 2007, pp. 1357–1367.
- [6] Hyunji Chung, Sangjin Lee, "Intelligent Virtual Assistant knows your Life," Computers and Society, Vol. 42, 2017, pp. 201–213.
- [7] Joao Santos, Joel J.P.C. Rodrigues, Joao Casal, Kashif Saleem, Victor Denisov, "Intelligent Personal Assistants Based on Internet of Things Approaches," IEEE Systems Journal, Vol. 12, Issue 2, pp:1793-1802, June 2018.
- [8] Kosuke Tsujino, Shinya Lizuka, Yusuke Nakashima, Yoshinori Isoda, "Speech Recognition and Spoken Language Understanding for Mobile Personal Assistants: a Case Study of 'Shabette Concier'," IEEE 14th International Conference on Mobile Data Management,3rd June 2013, pp. 1122–1142.
- [9] Michaela Iorga, Hyunji Chung,Jeffrey Voas, Sangjin Lee, "Alexa, Can I Trust You?," Computer, Vol.50, Issue 9, pp:100-104, 2017.
- [10] Peter Imrie, Peter M.Bednar, "Virtual Personal Assistant," The 10th conference of The Italian Chapter of AIS, Italy, 2013, pp. 137–148.
- [11] Poonam Patil S1, Rudrappa B Gujanatti2, "Alexa on Amazon Ecosystem," International Research Journal of Engineering and Technology, Volume: 04 Issue: 08 | Aug -2017 pp. 71–83.
- [12] Prajyot Mane, Shubham Sonone, Nachiket Gaikwad, Jyoti Ramteke, "Smart Personal Assistant using Machine Learning," International Conference on Energy, Communication, Data Analytics and Soft Computing(ICECDS),2nd August 2017 pp. 113–130.
- [13] Seema Rawat, Parv Gupta, Praveen kumar "Digital Life Assistant using Automated Speech Recognition" International Conference on Innovative Applications of Computational Intelligence on Power, Energy and Controls with their Impact on Humanity (CIPECH14), 28 & 29 November 2014, pp. 75–86.
- [14] Veton Kepuska, "Comparing Speech Recognition Systems(Microsoft API,Google API and CMU Sphinx)," International Journal of Engineering Research and Application, ISSN : 2248-9622, Vol. 07, Issue 3, (Part-2),pp: 20-24, March 2017.
- [15] Amazon Echo https://en.wikipedia.org/wiki/Amazon_Echo
- [16] <https://www.amazon.com/Amazon-SK705DI-Echo/dp/B00X4WHP5E>