

Amazon Alexa – Featured Generation Intelligent Voice Eco System

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ABSTRACT

Amazon Alexa, is Amazon's virtual personal assistant, offer customers an intuitive way to interact with the technology that they use every day. Alexa is designed to make life easier by voice control interaction. It can also control several smart devices and is a part of home automation known as domotics. Alexa's capabilities can be extended by installing skills. Alexa updates through cloud automatically and is continually learning, adding new functionality and skills. This paper covers how it works, what it's capable of doing, its skill sets, privacy concern and also about "Cielo Home" skill for Alexa which is a custom skill. Cielo Breez lets you control your air conditioners and heat pumps smartly and in combination with Alexa you have even more flexibility.

Keywords: Alexa, Echo, AVS, Domotics, ASK

INTRODUCTION

Amazon Alexa is a virtual assistant developed by Amazon, initially released in November 2014. First used in Amazon Echo and the Amazon Echo Dot smart speakers developed by Amazon lab126. It is capable of voice interaction, music playback, making to do lists, setting alarms, streaming podcasts, playing audio books, providing weather, traffic and other relative information such as news. Alexa can also control several smart devices using itself as a home automation system.



Fig-1: Amazon Alexa

Amazon Alexa is a cloud-based voice control system. Amazon Echo or Alexa are one and same. Amazon Echo without Alexa is just a speaker. Amazon Echo is hardware and Alexa is software. Updates through the cloud automatically and is continually learning, adding new functionalities and skills.

Echo is a device that uses speech recognition to perform an ever-going range of tasks on command. It has echo, few speakers, microphones and a small computer.

Air conditioners and heat pumps can also be controlled using simple voice commands. Using Cielo Breez with Alexa is simple, convenient and fun. It saves you energy and reduces your electricity bills for air conditioners. "Cielo Home" our custom Alexa skill gives you much more flexibility and added features to communicate with Alexa – e.g. now you can ask Alexa if air filter of your air conditioner needs cleaning. It will tell you if it is clean or you need to clean it to ensure healthy environment for you and your family.

Small computer in echo can perform no. of tasks when wake word (alexa, computer, echo, Amazon) is said. Alexa recognizes the word and starts recording the voice. When speaking is done, it sends recording over internet to Amazon and reply is sent back to the user through echo.

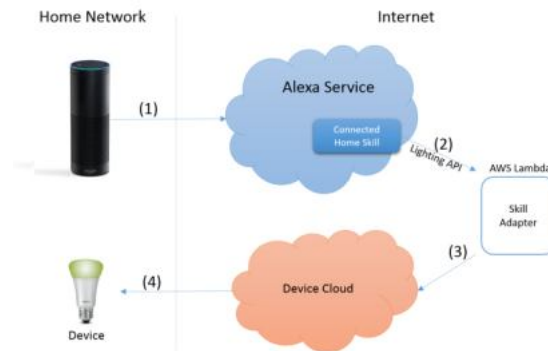


Fig 2: Alexa communication

Service that process this recording is called Alexa Voice Services (AVS), run by Amazon. This converts the recording into commands that it interprets. Its interpretation is simple. If you ask for time, AVS sends back an audio file of Alexa telling time, which echo plays back (or) user asks Alexa, what the weather in Chicago is today. And answer comes from speaker in female, slightly computer voice. Once the question is asked, microphone takes everything and beams it up to Amazon cloud for quick analysis.



Fig: Alexa communication with user

Echo connects to the internet via home Wi-Fi network. It's always on and listens for wake word. Once it hears that, the device gathers the voice commands that follow and sends them to a natural voice recognition service in cloud called AVS, which interprets them and send back the appropriate response. The device has an array of microphones that can pick up your voice from across the room.

Echo Hardware

Amazon Echo is a cylindrical device that measures around 9.25 inches in height and 3.27 inches in diameter. A microphone on/off button and an action button at the top of device provides some control options and they rest on a ring you can rotate to adjust speaker volume. Main control is the seven microphone array built in to the top, which uses beam forming technology and noise cancellation to hear your voice.

A light ring at the top outer edge provides status information, such as volume level, whether device is streaming audio or microphone is turned off, via various light colors.



Fig: Echo hardware

A led that lets user know the status of device Wi-Fi connection sits near base just above the power cord.

NEED FOR THE STUDY

All the latest versions of Alexa are includes simple Wi-Fi setup, which allows to connect compatible smart devices with the sound of your voice. It makes companies easier to create compatible devices like smart TVs, smart appliances and smart garage door controllers. With the ability of Bluetooth connection, it can be used as speaker and can also used to make VoIP calls. Using this ability, calling and texting features can also be integrated. Alexa can also be built in non- amazon devices. It offers Alexa Voice Service developer program to allow manufacturers to build their own Alexa devices.

OBJECTIVES OF THE STUDY

To implement all the features of Alexa it need Alexa Skill Set.

ALEXA SKILL SET (ASK)

Alexa provides a set of built-in capabilities referred to as skills. The Alexa skill set supports building different types of skills.

Custom skill, handles any type of request.

Smart home skill that lets user control and query cloud enabled smart home devices such as lights, door locks, cameras, thermostats and smart TV.

Video skill that lets user control cloud enabled video services.

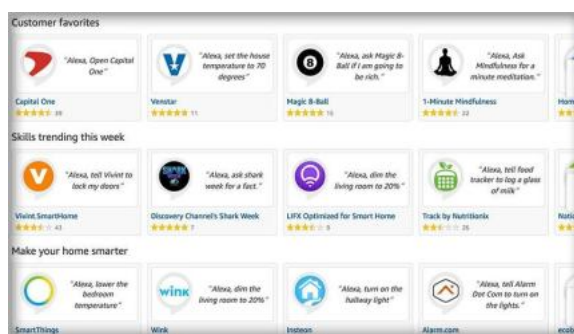


Fig: Alexa skill set

When a cloud based service is created, that handles the requests for the skill type and host it in the cloud. The Alexa services routes incoming requests to appropriate service. Different skills require different types of services.

LITERATURE REVIEW

For Amazon, which started as a platform for a better jukebox has become something bigger: an artificial intelligence system built upon, and constantly learning from, human data. Users have the opportunity to control or at least influence three important markets: home automation, home entertainment, and shopping. More than 15,000 “skills,” or apps, have been built so far, and appbuilding tools have become so easy to snap together that it’s now possible to build a simple skill in about an hour, without much programming knowledge. The more time Alexa spends with its users, the more data it collects to learn from, and the smarter it gets. Alexa doesn’t need to decode each utterance. Large samples and semi-supervised machine learning is enabled to do it. Improvement comes from machine-learning techniques that reexamined thousands of previous exchanges in which Alexa stumbled. To make Alexa a better listener, Amazon’s AI experts use so much data to make it a better speaker, fine-tuning voice, in order to boost usage. Traditional attempts at speech synthesis depend on fusing many snippets of recorded human speech.

DISCUSSION

Amazon’s Alexa is a cloud-based voice recognition service API that can answer questions and enable next-generation voice-enabled IoT ecosystem. Amazon uses “Echo” to refer to the hardware that is connected to Alexa Service. The list of things Amazon’s Alexa service can do is growing beyond imagination, and currently, it includes alarms and timers, checking for weather and sports, reading news headlines of the day, streaming music and answering general questions with searches on Bing and Wikipedia. Beyond these native

abilities, this virtual assistant can also be trained with new skills for managing other connected devices, and services. All these abilities need to be done through voice commands that follow the same basic setup.

The integration has gone mainstream enabling businesses and makers of any kind of connected device to put Alexa's brain in their product or service to achieve business advantage and manage operations with improved workflows and reduced time. Thus, enterprises and device manufacturers are incorporating Alexa connectivity, which provides intelligent, scalable and error-prone voice user interface.

Alexa Skills Kit SDK is the principle extensible instrument of Amazon Echo and one of the viewpoints that separate the stage from other conversational interface arrangements. Utilizing the SDK, engineers can create new voice commands that co-operate with Web Services or AWS Lambda functions to perform the task with voice command. From broadening SaaS frameworks with voice interfaces or streamlining existing business forms utilizing voice commands, the Alexa Skills Kit gives the model that adapts Amazon Echo in big business situations.

5 STEPS TO INTEGRATE ALEXA IN YOUR IOT ECOSYSTEM

Step 1: Use Amazon Echo through which user can send voice command to Alexa.

Step 2: Create skills set for the users to interact with their cloud-connected devices via voice. (skills such as turn on or off lights). Send a voice command via Echo or Mobile Application, which will work through its functionalities also known as Alexa skill Set. Each skill set is linked with an Alexa API for that particular command.

Step 3: Alexa API composes a message which is sent to the AWS lambda where the voice is processed and confirms the action. The lambda function communicates desired action to the device cloud

Step 4: The device's cloud, interprets the message and signals the device to turn on or off.

Step 5: A message is sent back to the Skills API whether it was successful or not. Alexa uses this response to provide feedback to the user.

AWS (Amazon Web Service) Lambda is a service that lets user run code in the cloud without managing servers. Alexa sends user code requests which is inspected and necessary actions are taken and then a response is send back.



Fig: process of communication.

Speech Synthesis Markup Language (SSML)

When the service for skill returns a response to a user's request is provided in text that the Alexa service converts to speech. Alexa automatically handles normal punctuation, such as pausing after a period, or speaking a sentence ending in a question mark as a question. The Alexa Skills Kit provides this type of control with *Speech Synthesis Markup Language (SSML)* support.

Speech Synthesis Markup Language, or SSML, is a standardized markup language that allows developers to control pronunciation, intonation, timing, and emotion. SSML support on Alexa allows you to control how Alexa generates speech from your skill's text responses. You can add pauses, change pronunciation, spell out a word, add short audio snippets, and insert speechcons (special words and phrases) into your skill. These

SSML features provide a more natural voice experience. Alexa Skills Kit supports a *subset* of the tags defined in the SSML specification. The specific tags supported are listed in Supported SSML Tags.

SSML Tags

Whispers – Convey a softer dialog with `<amazon:effect name="whispered">`.

Expletive beeps – Bleep out words with `<say-as interpret-as="expletive">`.

Sub– Use the `<sub>` tag when you want Alexa to say something other than what’s written.

Emphasis – Add `<emphasis>` to change the rate and volume at which Alexa speaks.

Prosody – Use this tag to control the volume, pitch, and rate of speech

`<amazon:effect name="whispered">`

The new `amazon:effect` tag coupled with the name: “whispered” allows Alexa to convey a softer dialog. Notice in the sample below, that `amazon:effect` requires a closing tag.

`<say>`

The user name is Alexa Devs and the password is... wait, come closer...

`<amazon:effect name="whispered">the password is whisper. </amazon:effect>`

`</say>`

The Alexa Skills Kit (ASK) enables developers to build capabilities, called skills, for Alexa. ASK is a collection of self-service APIs, documentation, tools, and code samples that make it fast and easy for anyone to add skills to Alexa.

Collaboration with Cielo

Cielo Smart Home skill offers various operational features that are supported by Alexa. The following operations can be done, asking Alexa about your air conditioner’s air filter status, usage history and many more. To do so, configure “Cielo Home” skill for Alexa (the custom skill).

Cielo configuration:

To configure Cielo the following steps have to be followed:

Step1: Login to Amazon Alexa:

To sign in, enter your login credentials for your Alexa app and press the “Sign In” button.

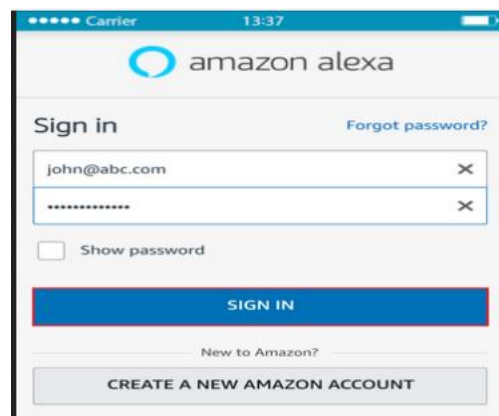


Fig: Signing up for Amazon Alexa

Step 2: Enable Skill and Link Account

On the home Screen open the side menu by pressing the “hamburger menu icon”. The side menu will slide in. From this menu press the “Skills” option. It will open the “All Skills” screen. Tap on the search bar and type ‘Cielo Smart Home’ and press search. The “Cielo Smart Home” skill will appear in the search results. Select the “Cielo Smart Home” skill.



Enter your 'Cielo Home' mobile app account Username and Password and press "Login".



If the credentials are valid and the code grant is successful, you will see the next message with this message 'To continue, close this window to discover devices you can control with Alexa.' On closing the page, you will see a popup on the main skill page for discovering devices. Select the 'Discover Devices' option or cancel to discover by voice command to Alexa. Alexa will start looking for devices and will take around 20 seconds. To add more devices, you can register Cielo Smart Controllers with Cielo Home App and say 'Alexa, discover my Devices'. You are now all set-up to start using the 'Cielo Smart Home' skill.

Step 3: Alexa Voice Commands for Cielo Smart Controllers

The 'Cielo Smart Home' skill includes all the capabilities in any other smart home skill to allow voice control for Cielo Smart Controllers for your Air Conditioners & Heat Pumps. The skill is simple and easy to use and provides immediate control without any need of invoking the skill. It is capable of handling the following commands:

- Turn on / Turn Off, e.g. *Alexa, turn on/off Bedroom.*
- Increase/Decrease temperature, e.g. *Alexa, increase/decrease the Bedroom by 2 degrees.*
- Set thermostat temperature, e.g. *Alexa, set Bedroom to 72 degrees.*
- Ask the current set temperature of the specified device, e.g. *Alexa, what is bedroom set to?*
- Ask the current temperature reading or ambient temperature detected by the device, e.g. *Alexa, what is the temperature of Bedroom?*

Step 4: Alexa Compatible Device Names

Cielo Smart Controllers names should be compatible with Alexa. Alexa does not understand names with special characters or numbers. It only understands simple English names for devices. To use Alexa with

Cielo Smart Controllers, we recommend users to name these devices accordingly. Following guidelines must be followed for Alexa to be able to control your Cielo Smart Controllers for your air conditioners & heat pumps:

- Use names with alphabets only and unique names that are unique to hear as well. For e.g. “Bedroom”, “Bed Room”, “bedroom”, “bed ROOM” all are unique in writing but not in hearing. Alexa will hear “bedroom” for all these names. Alexa will only send the command to the device that comes first in the search if there are two devices with similar names.
- Alexa will not be able to identify device if there are any spell mistakes, for e.g. “bedrooom”.
- Alexa will not be able to identify names with special characters or numeric, for e.g. “b3dr00m”, “bedrom.”

LIMITATIONS

Even though Alexa is popular, it has few limitations. Sometimes, things might not work exactly how you would expect them to. For example, to create a shopping list by telling Alexa to add fire crackers or beer to list, each item must be added separately. Instead of “Alexa, add fire crackers and beer to my shopping list”, it is “Alexa, add fire crackers to my shopping list and Alexa, add beer to my shopping list”. This process is annoying if list is big.

Alexa has a limited no. of wake words i.e; “Alexa”, “Echo”, “Amazon”, “computer”. Owners can change each Alexa device name, but it gets confusing to remember which one responds to “Alexa” and which one to “Computer”. This problem is resolved by second generation echo having new Echo Spatial Perception technology which activates voice commands from one echo device, one closest to you regardless of many devices in room.

Sometimes, Alexa can't hear request due to background noise or it is playing music too loudly. This is also resolved in second generation Echo which can hear and understand voice commands even with music playing in high volume.

CONCLUSION

Smart home devices make life easier at home and give users the ability to do several things at the same time. The more you talk to Alexa, the more it adapts to speech patterns, vocabulary, personal preferences. Alexa comes included with Echo and other Alexa devices.

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