

Let Us Create an Alexa Skill for Our IoT Device Inside the AWS Cloud

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ABSTRACT

Purpose: The Internet of Things (IoT) has changed how we interact with technology, allowing us to control and monitor devices remotely from our smartphones or other devices. One of the most popular ways of interacting with IoT devices is through voice assistants like Amazon Alexa. To integrate an IoT device with Alexa, developers must create a custom Alexa skill to understand voice commands and communicate with the IoT device. This research paper presents a practical guide for developers interested in creating custom Alexa skills for their IoT devices. It covers the essential steps in setting up the AWS IoT platform, designing the Alexa skill's interaction model, and testing the Skill.

Design/Methodology/Approach: We decided which load or equipment would be operated using the Alexa voice command. Then we thought about quickly consuming minimal words for each device operation. We prepared the command list in the Excel sheet and a command prototype for Alexa utterances. We created an AWS account in the AWS cloud server and started to create the new Skill. Finally, we must add the AWS lambda function ARN to the Alexa default Endpoint to update the IoT Device shadow for connected devices.

Findings/Result: This research demonstrates that the development of an Alexa skill for IoT devices in the AWS Cloud is a reliable, efficient, and flexible approach that has the potential to revolutionize the way we interact with IoT devices in our daily lives.

Originality/value: The novelty of this research lies in the fact that it provides a step-by-step guide to developing an Alexa skill for IoT devices in the AWS Cloud. It will also help researchers and developers understand the complexities of developing Alexa skills for IoT devices in the AWS Cloud and how these skills can be used to control IoT devices anywhere. This research will add value to the field by providing developers with the necessary tools and techniques to develop sophisticated and reliable Alexa skills for IoT devices in the AWS Cloud.

Paper Type: Experimental-based Research.

Keywords: Alexa skill, IoT devices, AWS Cloud, AWS IoT, voice-controlled intelligent home automation.

1. INTRODUCTION :

The Internet of Things (IoT) has revolutionized how we interact with technology, allowing us to control and monitor devices remotely from our smartphones or other devices. One of the most popular ways of interacting with IoT devices is through voice assistants like Amazon Alexa. In order to integrate an IoT device with Alexa, developers need to create a custom Alexa skill that can understand voice commands and communicate with the IoT device. In this context, we provide a practical guide for developers interested in creating custom Alexa skills for their IoT devices. Here we cover the essential steps in setting up the AWS IoT platform and registering the IoT device to handle requests from the Alexa skill. The developers can create a custom Alexa skill allowing users to interact with their IoT devices using natural language commands. This will enhance the user experience and expand the possibilities for IoT device functionality.

The paper is organized as follows: Section 2 provides an overview of related work already done on IoT. Section 3 discusses the objective of the research work. Section 4 highlights the methodology we used for the research work. In section 5, we do the actual experiment. This section describes the procedure with a required screenshot to create an IoT in the AWS cloud. Section 6 provides recommendations for reading to understand the research topic better. Finally, Section 7 concludes the paper and provides future research directions.

2. RELATED WORKS :

Yadavalli et al. (2020) proposed an intelligent IoT system for monitoring and controlling livestock parameters. The system monitors real-time parameters such as temperature, humidity, etc [1]. Xiaoguang et al. (2018) designed and implemented an intelligent cooking system using Amazon Echo [2]. Abraham et al. (2019) discussed the teaching of embedded systems in the context of IoT. The authors presented a case study on teaching embedded systems with IoT projects [3]. Babun et al. (2021) surveyed IoT platforms from communication, security, and privacy perspectives. The authors reviewed various IoT platforms and discussed their strengths and weaknesses [4]. Zhu et al. (2019) presented an edge computing platform for a guide-dog robot for the visually impaired. The platform enables the robot to navigate complex environments using sensors and cameras [5]. Burd et al. (2018) discussed courses, content, and tools for IoT in computer science education. The authors presented a framework for teaching IoT in computer science courses [6]. Kandpal et al. (2020) proposed a contextual chatbot for healthcare purposes using deep learning. The chatbot enables patients to interact with healthcare providers using natural language [7]. Bansal and Bansal (2020) discussed IoT applications in smart homes. The authors presented a survey of secure and intelligent industrial applications of IoT using Microsoft Azure [8]. Florea and Stray (2019) researched the skills employers seek in software testers. The authors discussed the importance of testing in IoT and identified the skills required for IoT testing [9]. Dhayanidhi (2022) researched IoT threats and the implementation of AI/ML to address emerging cybersecurity issues in IoT with cloud computing. The author proposed a framework for securing IoT devices using AI and cloud computing [10].

3. OBJECTIVES :

The objectives of this research on developing an Alexa skill for IoT devices in the AWS Cloud are as follows:

- (1) To develop a reliable and efficient Alexa skill that provides users seamless control over their IoT devices in the AWS Cloud.
- (2) To investigate using AWS services such as AWS Lambda and AWS IoT to develop an Alexa skill for IoT devices in the AWS Cloud.
- (3) To design and implement a development framework that ensures the final product is scalable, maintainable, and extensible.
- (4) To compare the performance and usability of the Alexa skill for IoT devices in the AWS Cloud with other voice-controlled intelligent home automation solutions available in the market.
- (5) To identify the limitations and challenges of developing an Alexa skill for IoT devices in the AWS Cloud and suggest possible solutions for addressing them.
- (6) To contribute to the existing body of knowledge on voice-controlled intelligent home automation and IoT devices by providing a comprehensive and systematic approach to developing an Alexa skill for IoT devices in the AWS Cloud.

4. APPROACH AND METHODOLOGY :

Creating an Alexa Skill for an IoT device involves integrating the device with the Alexa Voice Service (AVS) using Amazon Web Services (AWS).

- ✓ **Choose IoT device:** The first step is to select the device we want to integrate with Alexa. This device should be capable of connecting to the internet and should have a unique identifier.
- ✓ **Set up IoT device:** set it up with AWS IoT Core. AWS IoT Core is a managed cloud service that enables devices to connect securely and interact with AWS services. Create a Thing in AWS IoT Core, which represents the IoT device, and associate it with the device certificate and policy.

- ✓ **Create a Lambda function:** A Lambda function is an AWS service that enables you to run code without provisioning or managing servers. Create a new Lambda function that will handle the requests from Alexa to control your IoT device.
- ✓ **Set up an Alexa Skill:** Create a new one in the Alexa Developer Console. Choose a name and invocation phrase for your Skill, and define the intents and sample utterances that users will say to control your IoT device.
- ✓ **Connect your Lambda function to Alexa:** In the Alexa Developer Console, configure the Endpoint for your Alexa Skill to point to your Lambda function. This will allow Alexa to forward the user's voice commands to our Lambda function.
- ✓ **Test Skill:** Test Alexa Skill using the Alexa Developer Console or an Alexa-enabled device. Verify that our Skill can successfully control the IoT device using voice commands.

5. EXPERIMENT :

Now it is time to do some experiments. The below procedure needs to follow to create Alexa Skill for our IoT Devices.

Create Skill:

- 1) To create Skill, we need to create an AWS account. If an account is not available, we need to create one.
- 2) Once the account is created, Open <https://developer.amazon.com/alexa/console/ask>.

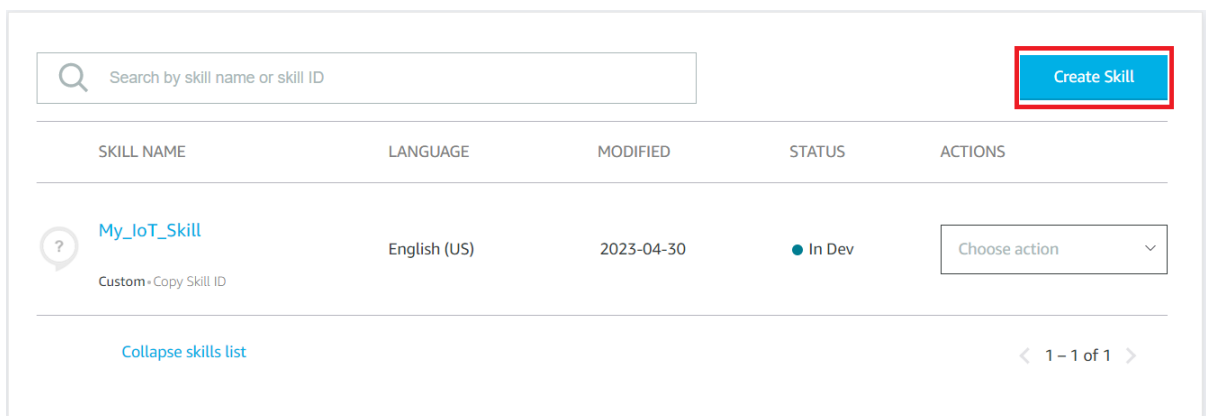


Fig. 1: "Create Skill" button [source: <https://developer.amazon.com/alexa/console/ask>]

- 3) Click on the "Create skill" button, depicted in Figure 1.
- 4) Inside the "Skill name" textbox, add the Skill name, like: "My_IoT_Skill."
- 5) Choose a primary locale: "English (US)." Click on "Next."
- 6) Choose a type of experience: select the other radio button.
- 7) Scroll down. Under "Choose a model," keep selecting "Custom."
- 8) Scroll down. Under the "Hosting services," keep selecting "Alexa-hosted(Node.js)."
- 9) Scroll down. One important selection is the "Hosting region." We need to select the nearest server to respond as quickly as possible. Figure 2 depicts the region selection.

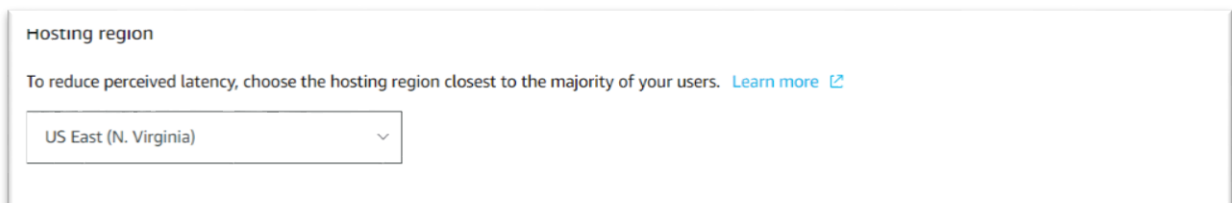


Fig. 2: "Hosting region" selection [source: <https://developer.amazon.com/alexa/console/ask>]

- 10) Click on the "Next" button.
- 11) Keep selecting "Start from Scratch." click on the "Next" button.

12) Under the “Review your selections.” Section, Verify the parameter depicted in Figure 3, Especially “Hosting region.”

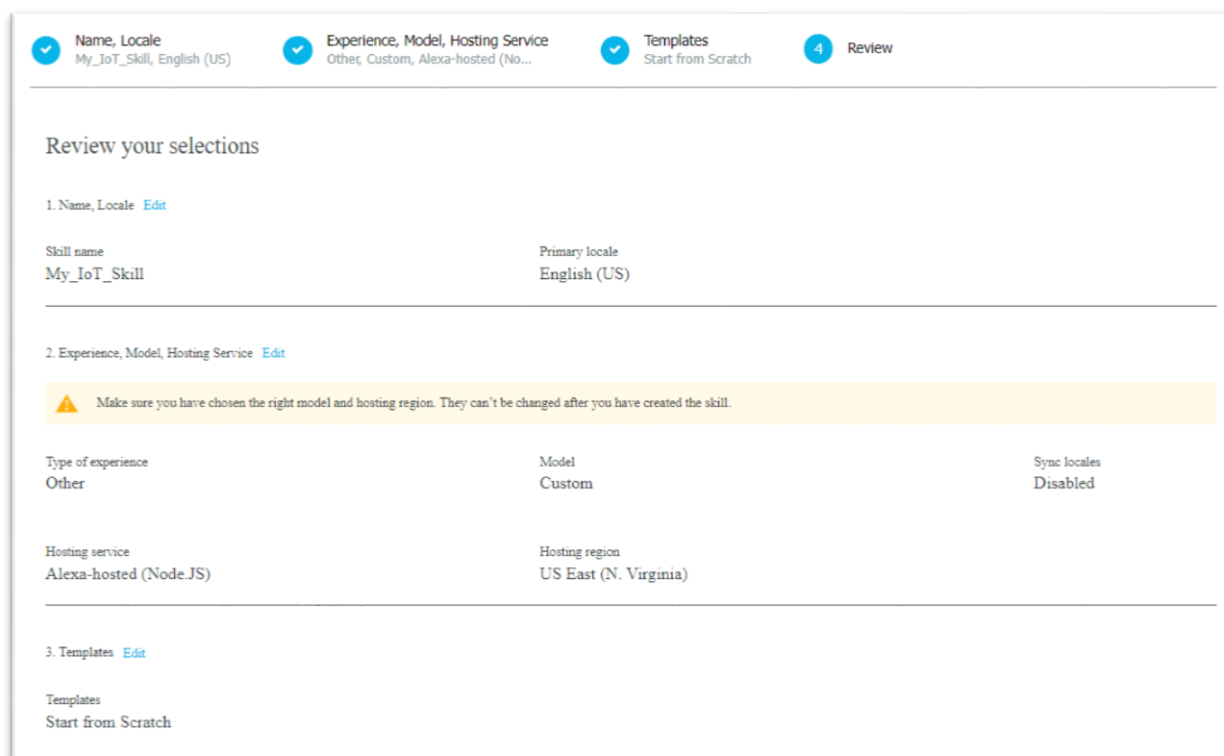


Fig. 3: “Review your selections” [source: <https://developer.amazon.com/alexa/console/ask>]

Click on the “**Create Skill**” button. It might be taken a couple of minutes. Figure 4 depicts that the process is ongoing. Once completed, the confirmation message is visible, depicted in Figure 5.

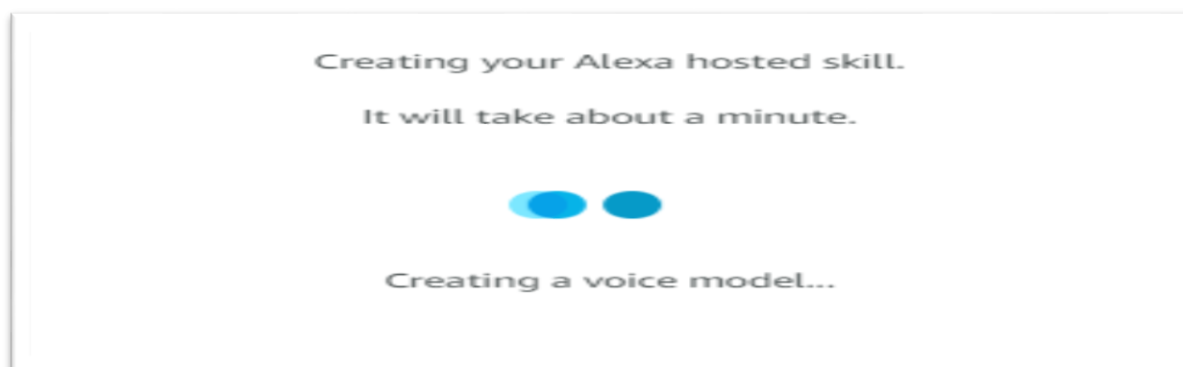


Fig. 4: Skill creation ongoing.. [source: <https://developer.amazon.com/alexa/console/ask>]

13) The Skill is now created.

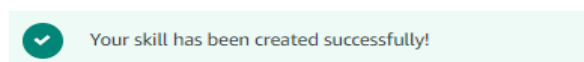


Fig. 5: Skill created. [source: <https://developer.amazon.com/alexa/console/ask>]

Invocation creation:

1) From the left sidebar, under Invocations, click “**Skill Invocation Name.**” change the name: to “**My home.**” Depicted in Figure 6.

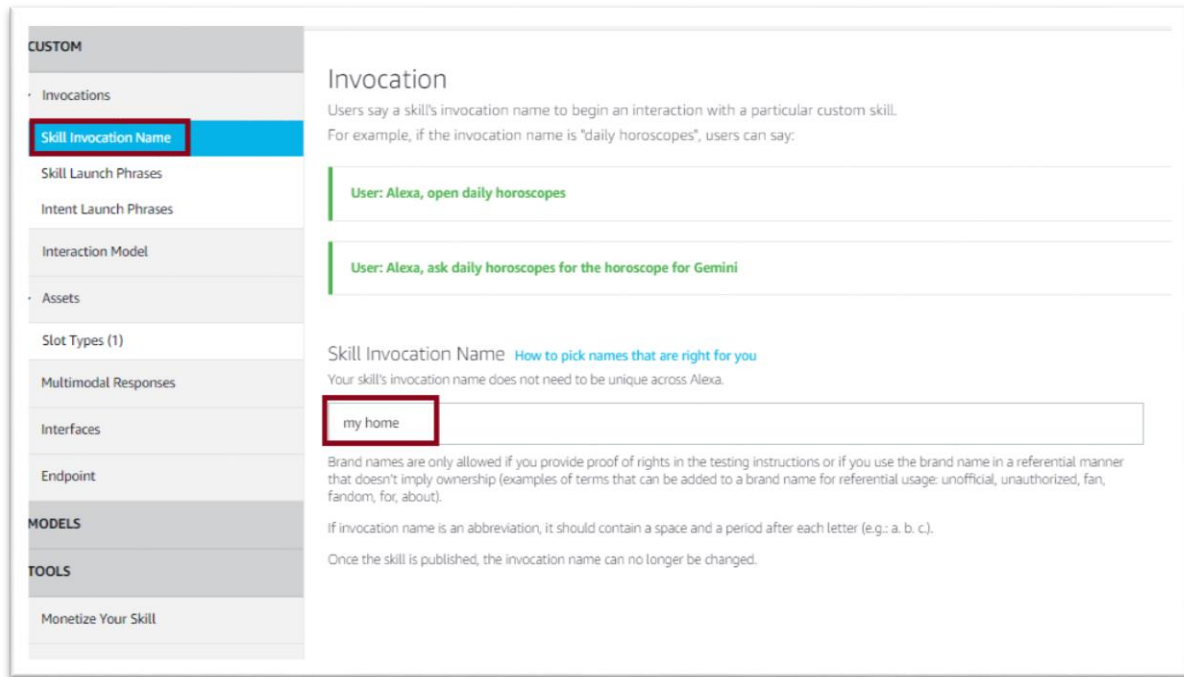


Fig. 6: Skill Invocation Name. [source: <https://developer.amazon.com/alexa/console/ask>]

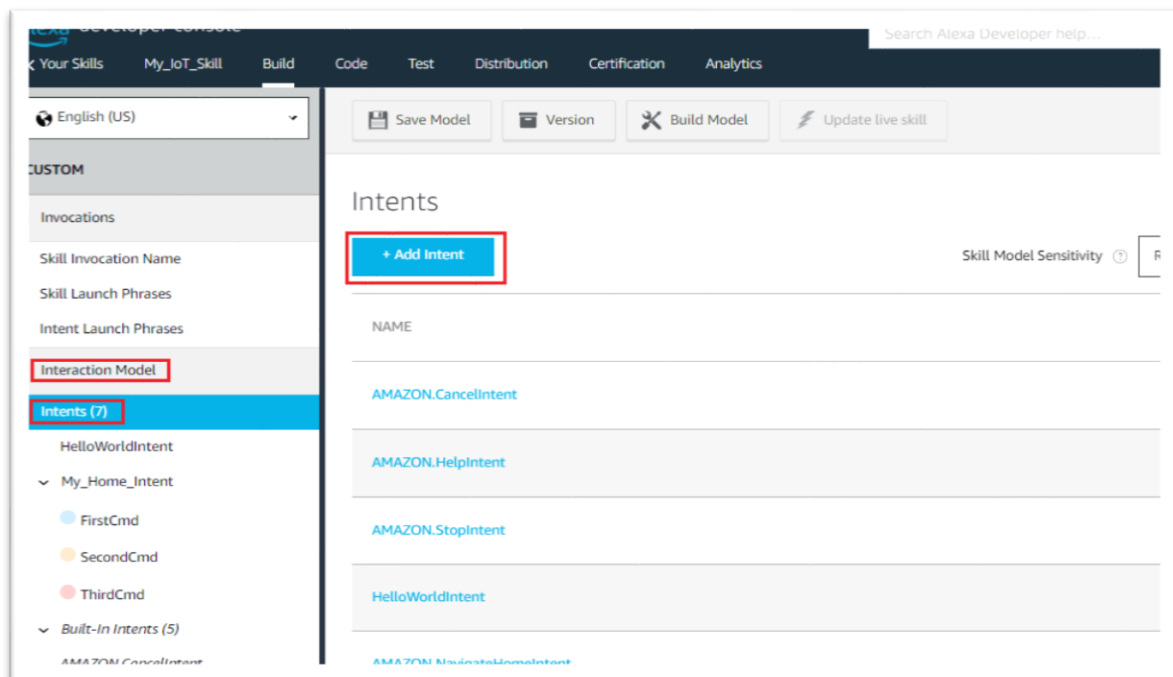


Fig. 7: Add Intent button. [source: <https://developer.amazon.com/alexa/console/ask>]

- 2) Under **Interaction Model**, click on “**Intents.**” From the right side, Click on “**+ Add Intent.**” Button. It is depicted in Figure 7.
- 3) Add a name to the “**Create custom intent**” textbox: “**My_Home_Intent.**” press the “**Create custom intent**” button.
- 4) Under the “**Intents/My_Home_Intent,**” inside the Sample Utterances box, we need to add command text.

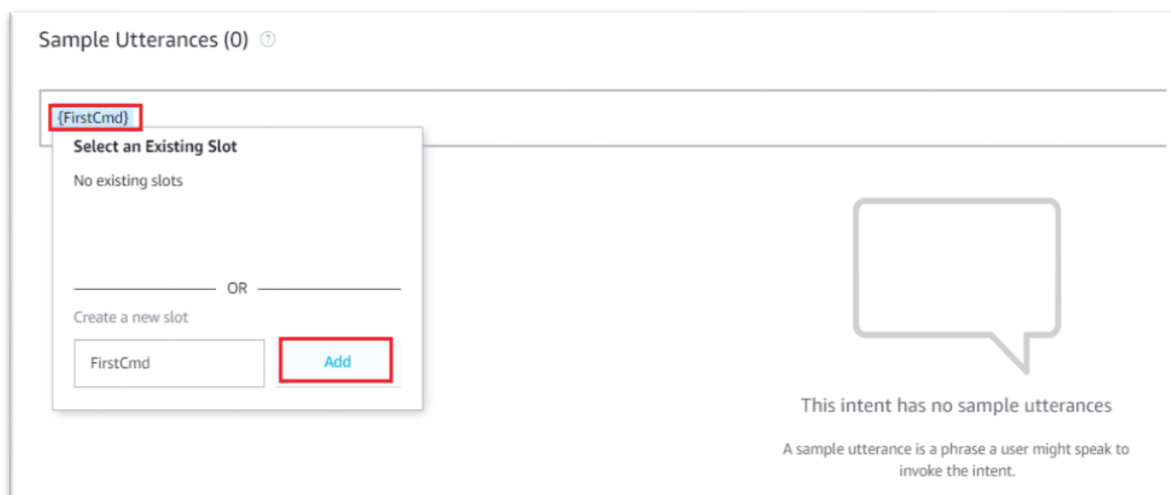


Fig. 8: Slot Add button. [source: <https://developer.amazon.com/alexa/console/ask>]

- 5) Type `{FirstCmd}` and observe one small window appear. Click on the “Add” button. Here we add a slot called “`FirstCmd`.” Depicted in Figure 8.
- 6) We add `{SecondCmd}{ThirdCmd}` slot using the same procedure. The final addition looks like Figure 9.

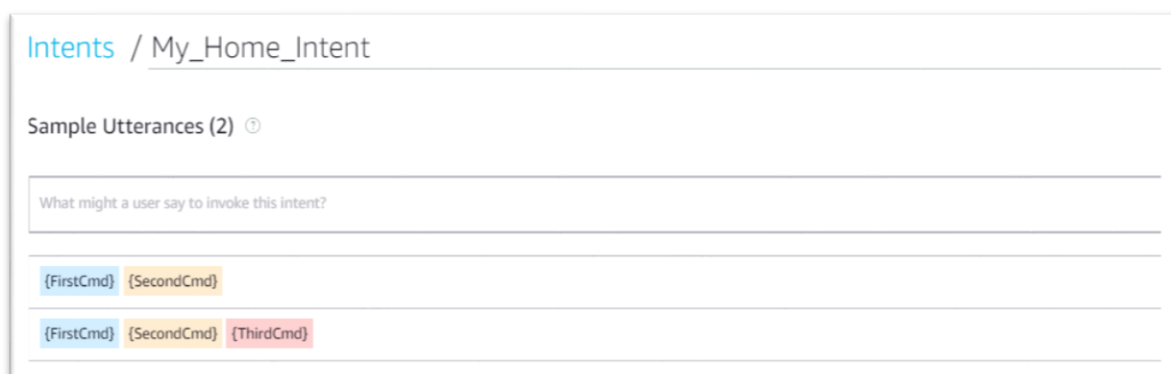


Fig. 9: Three Slots added. [source: <https://developer.amazon.com/alexa/console/ask>]

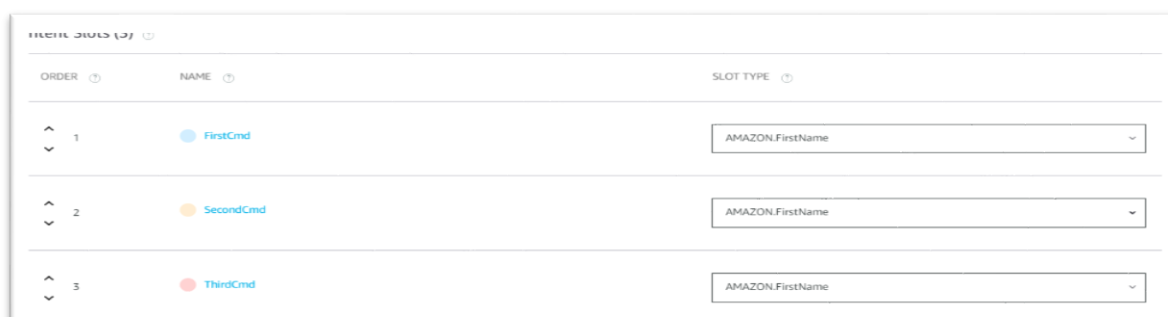


Fig. 10: Slots type selection. [source: <https://developer.amazon.com/alexa/console/ask>]

- 7) At the bottom side, select SLOT TYPE for three slots as “AMAZON.FirstName.” depicted in Figure 10.

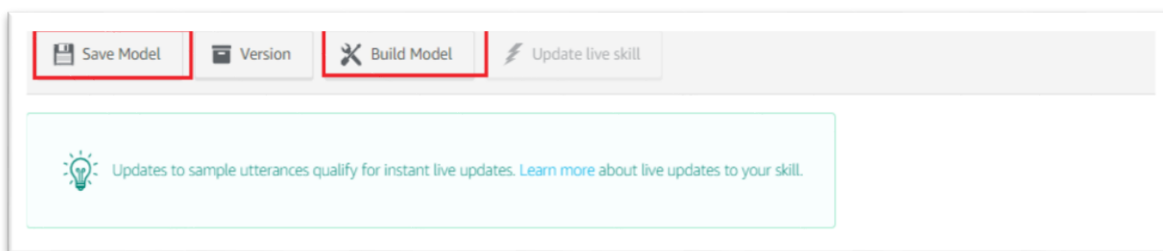


Fig. 11: “Save Model” and “Build Model button. [source: <https://developer.amazon.com/alexa/console/ask>]

- 8) At the Top, click “Save Model” and then “Build Model.” Depicted figure 5.11
- 9) From the left side, click on “Endpoint.” From the right side, copy “Your Skill ID.”

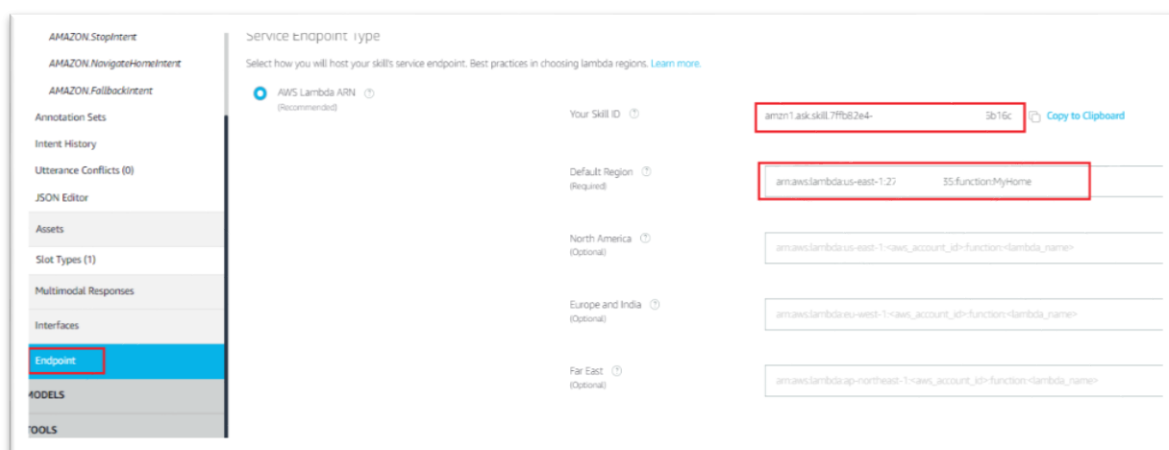


Fig. 12: End point entry. [source: <https://developer.amazon.com/alexa/console/ask>]

Inside the default region, paste the lambda ARN. (available from Lambda console). As depicted in Figure 12

- 10) At the Top, click on “Save Endpoints.” Depicted in Figure 13.

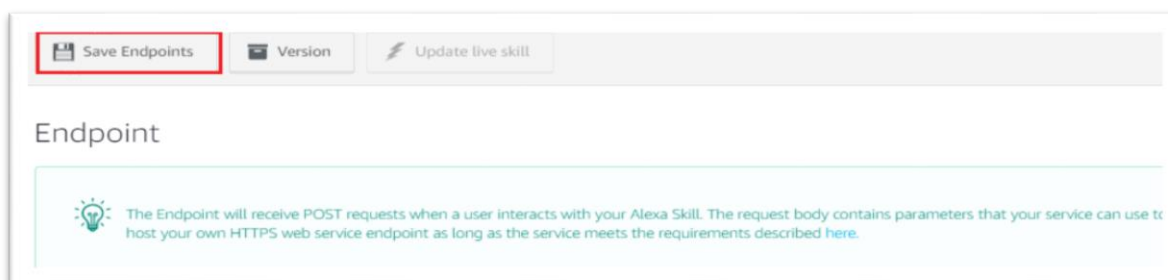


Fig. 13: Save Endpoints button. [source: <https://developer.amazon.com/alexa/console/ask>]

- 11) Now we need to test the Alexa. At the top menu bar, there is a “Test” button. Click on it. The test page will appear. “Skill testing is enabled in” select “Development.” by default, it is disabled.
- 12) Now Type or say “open my home” just below the textbox. It is the invocation name. The input command will fetch the lambda function, and the reply message will be played into the speaker.
- 13) Figure 5.14 depicts the test command input into the Alexa console.

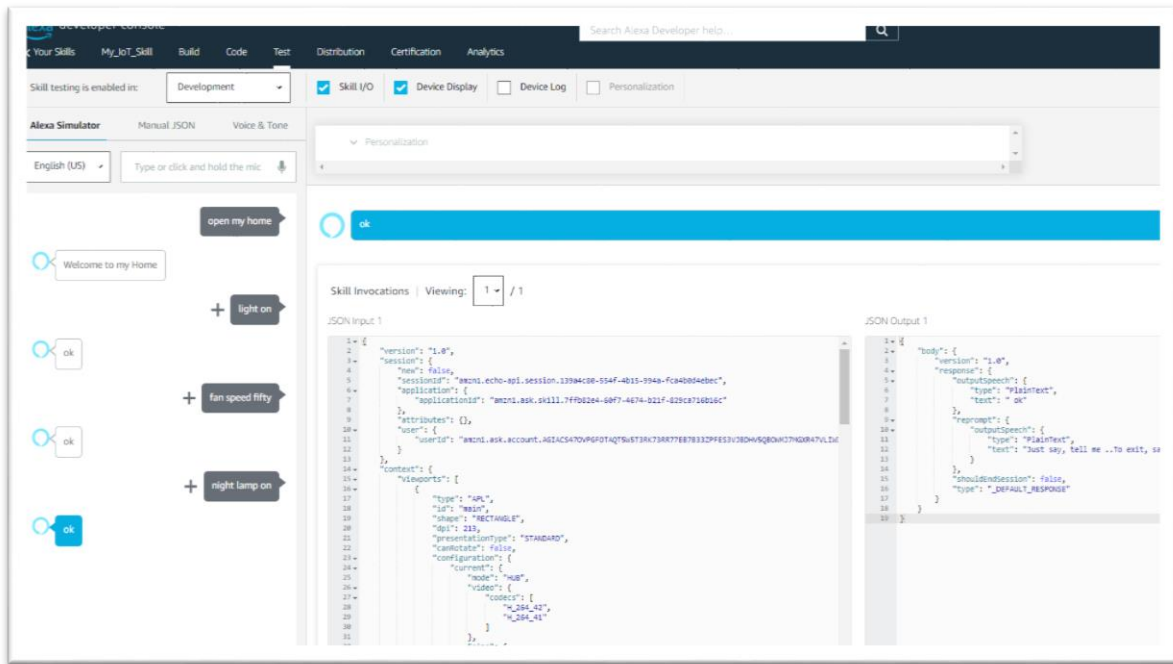


Fig. 14: Alexa test interface. [source: <https://developer.amazon.com/alexa/console/ask>]

Lambda Function:

- 1) Now we will see an overview of the lambda function. For the lambda function, open <https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions>,
- 2) after creating a lambda function, it will be listed in the site depicted in Figure 15.

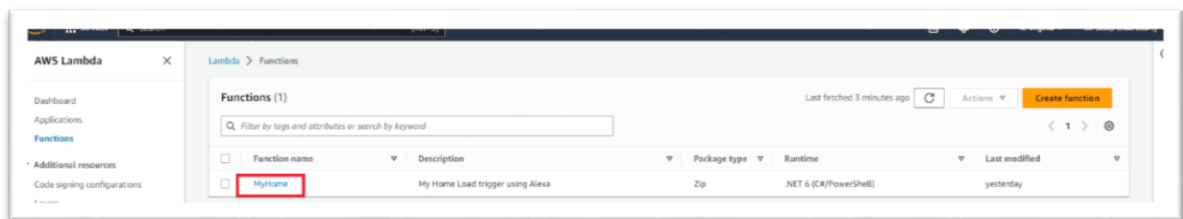


Fig. 15: Lambda function. [source: <https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions>]

- 3) Click on the **function name**, and the function overview will be displayed. On the right side, **Function ARN** available depicts in Figure 16. copy it and paste into the Alexa default Endpoint textbox.

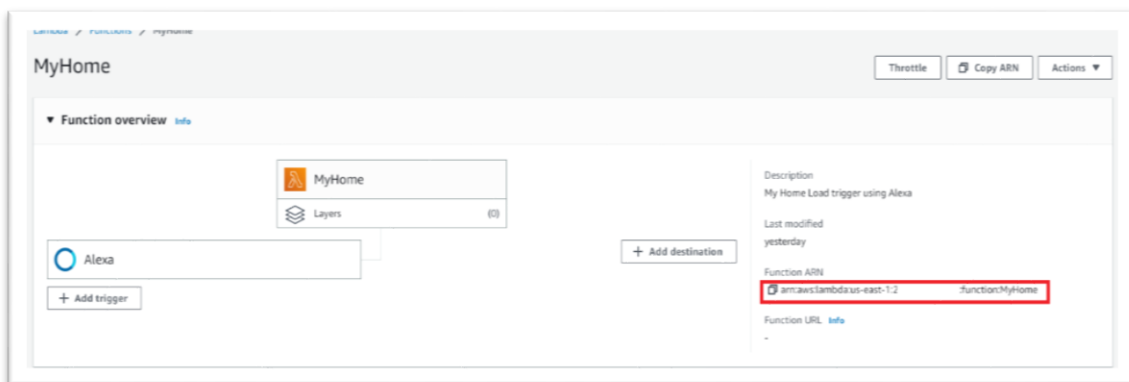


Fig. 16: Lambda function. [source: <https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions>]

- 4) Click on the “+Add trigger” button.
- 5) From the dropdown menu, select Alexa. The windows will expand and will be provided to add **Skill ID**.
- 6) Copy the **Alexa Skill ID** and paste it inside the “Skill ID” textbox. As depicted in Figure 17.

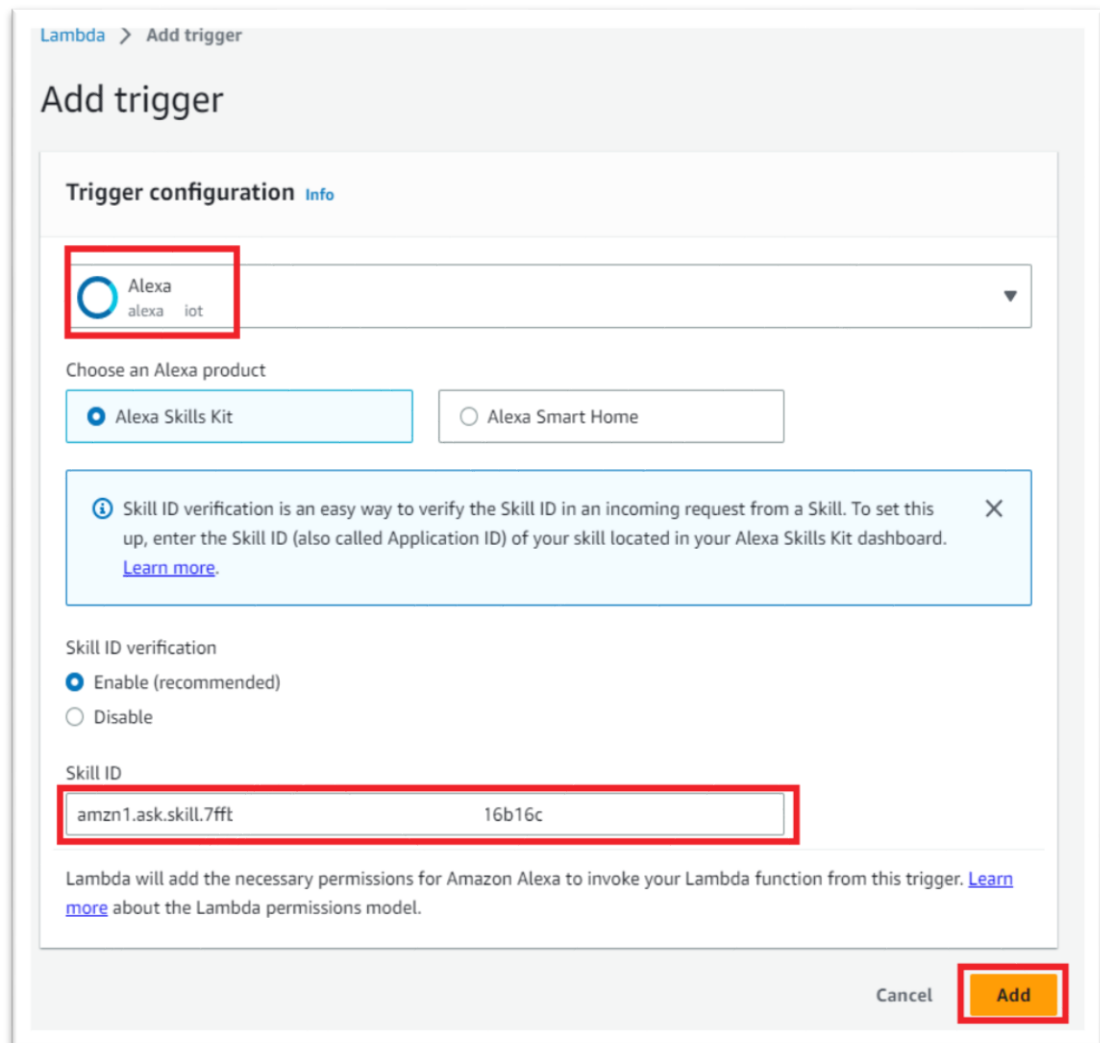


Fig. 17: Skill ID Input box. [source: <https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions>]

- 7) Click on the “Add” button. Now our lambda function is capable of receiving the Alexa command. Now we can speak in front of an Alexa device. The command will come in text form. Our Lambda function will parse and update the device shadow. As well as Alexa will play the response message.

6. RECOMMENDATIONS :

- ✚ This paper provides reference information to create Alexa-enabled IoT devices. The below-enlisted papers can be treated as a reference for IoT-based research work [11-15]. All papers are practical-oriented.
- ✚ The researcher interested in IoT using Sinric Pro can Navigate: <https://www.srinivaspublication.com/journal/index.php/ijcsbe/article/view/1980>

- ✚ One good reference on Virtual IoT device Creation using Sinric Pro:
<https://www.srinivaspublication.com/journal/index.php/ijaeml/article/view/2093/817>
- ✚ How to create IoT inside the AWS cloud:
<https://www.srinivaspublication.com/journal/index.php/ijcsbe/article/view/2283/875>
- ✚ Physical IoT device creation using AWS and ESP module:
<https://www.srinivaspublication.com/journal/index.php/ijmmts/article/view/2321/881>
- ✚ Create Multiple IoT Device Controller Using AWS, ESP32, and C#:
<https://www.srinivaspublication.com/journal/index.php/ijaeml/article/view/2359/896>

7. CONCLUSION :

The paper presents a comprehensive guide for developers interested in creating custom Alexa skills for their IoT devices. The developers can create a powerful, user-friendly voice interface allowing users to control and monitor their IoT devices easily. Here we covered the essential steps in setting up the AWS IoT platform and designing the Alexa skill's interaction model. The guide also highlights the potential applications of Alexa skills for IoT devices and the benefits of using the AWS cloud platform for IoT development. Overall, it provides a valuable resource for developers looking to enhance their IoT devices' functionality and user experience through voice assistants like Amazon Alexa.

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