

February 16th, 2021

Dr. Craig Scratchley  
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Simon Fraser University  
Burnaby, BC, V5A 1S6

**PEPPERMONT**

Re: ENSC 405 Requirement Specification for *EZSpice*

Dear Dr. Scratchley,

This document proposes the requirement specifications for our product *EZSpice*, an intelligent machine for the kitchen. *EZSpice* will dispense the desired spice with precise quantity for the consumer while they are cooking. We are striving to create this product with reasonable costs to significantly improve the accessibility of cooking spices to households or even to the restaurant. The detailed requirement specifications for the different subsystems of *EZSpice* are described in this document. This document also shows the basic timeline of deliverables from Proof-of-Concept to Final Product.

Our team consists of 6 senior SFU engineering students with huge enthusiasm in our product (in alphabetical order of Last name): Minh Dinh, Yuxiang Huang, Jiaxi Lin, Xing Shen, Vi Thai, and Lingchong Weng. We plan to meet consistently and hold each other accountable for this project, and are confident with what we will produce.

Thank you for reviewing this requirement specifications document and future documents. If you have any questions or concerns, please contact us through GitLab or contact Minh Dinh, our Chief Communications Officer, via [qdin@sfu.ca](mailto:qdin@sfu.ca).

Sincerely,



Jiaxi Lin  
CEO  
Peppermint Inc.

# PEPPERMONT

## Requirements Specifications for *EZSpice*

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## **Abstract**

This document provides detailed specifications for the requirements of *EZSpice* featured by Peppermint Inc. First, it will introduce the background of the product, its intended audience, and its main functionalities. Then the requirements of each component will be discussed in a specific manner. All the requirements will be clearly marked by strictly following the requirements classification. The requirements for *EZSpice* mainly consists of the following sections:

- System Requirements: explains the overview of the system and functional requirements.
- Software Requirements: includes general, speech recognition, and performance requirements.
- Hardware Requirements: contains electronic, mechanical, and power source requirements.

Engineering Standards, Sustainability and Safety factors of the product will also be explained comprehensively. The goal of this document is to give the audience a detailed understanding of our product, its solution, and its operation while omitting the design specifications temporarily which will be described in the future documentations. Finally, this requirement specification document will be concluded by summarizing the requirements and demonstrating the Acceptance Test Plan.

## Glossary

<b>EZSpice</b>	The smart cooking spice dispensing machine which will be featured by Peppermint with the purpose of using spices in an easy way.
<b>Raspberry Pi</b>	One type of small single-board computer developed by the U.K.
<b>GPIO</b>	General-Purpose Input/Output pins embedded at the top edge of the Raspberry Pi board.
<b>Speech recognition</b>	Convert the sentences of voice command into text.
<b>RAM</b>	Randomly Accessed Memory is a type of computer memory that can be retrieved and modified at any time.
<b>ROM</b>	Read-Only Memory is a type of computer memory that cannot be modified after being manufactured.

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# **1. Introduction**

*EZSpice* - Make cooking easier! *EZSpice* is a spice dispensing machine that can be voice controlled and screen input by the user through the built in microphone in order to acquire desired quantities of specific cooking seasoning powders or sauces and can memorize the user's favourite recipes.

The product will be built with an user-friendly and intuitive interface without any complex installation by just plugging in the household voltage socket.

## **1.1 Background**

As the culture of cuisine spreads around the world, many families have a lot of spices in their kitchen. These spices may not only be limited to local dish spices, but also others that come from other countries in order for them to make different styles of foods. However, with the increasing amounts of spices in their kitchen, it becomes a real problem for individuals to find the correct one. For some individuals that are not experienced in cooking, using the correct quantity of spices is also a big trouble.

While in the current market, there exists a very limited number of devices that could help solving these spice issues. Thus, our company has come up with this idea ---*EZSpice*, to crack this difficulty. To achieve the goal, *EZSpice* will be designed to process users' voice commands and deliver the spice with the requested quantity.

## **1.2 Scope**

This document outlines the system overview of the device, and all the functional requirements of *EZSpice*, including the requirement of both software and electrical part, to be met by our team at Peppermint Inc. This includes the general functional requirements that must be met by the system as a whole, as well as the requirement specifications for each component. These requirements will also be categorized by their stage of development, i.e. proof of concept, prototype, and finished product. Engineering Standards and efforts toward Sustainability/safety will be outlined at the rear part of the document.

## **1.3 Intended Audience**

The target audience for this project will be those who are suffering from finding specific spice while cooking, who cannot acquire the amount of desired spice precisely or those who want to have a more convenient way to access their cooking spices. Users only need to have a basic knowledge of how to use a touch screen with the ability to follow on screen instructions. No special expertise or experience is required. In the future plan, this product will also be aimed at

those not only individuals but also professional cooks who have a large amount of different kinds of spices and want a solution to simplify the searching process.

## **1.4 Requirement Classification**

For the purposes of clarification and prioritization, the following convention will be used to label the requirement specifications throughout this document:

**[Req {Section}.{Subsection}.{Specification Number}{Phase of Development}]**

The following table explains different phases of the development process and its encoding:

<b>Encoding</b>	<b>Phase of Development</b>	<b>Deadline of each phase</b>
C	Proof of Concept	End of ENSC 405W
P	Prototype	End of ENSC 440
F	Final Product	In production

Table 1.4- Development Stage Encoding

## 2. System Overview

*EZSpice* is a device used for storing a variety of seasonings and dispensing the exact amount of any individual seasoning or a combination of seasoning mixture according to the user's request. The user can input requests either by voice or manually via the graphical user interface on the touchscreen. The *EZSpice* can assist home cooks with seasoning preparation for their dishes while they are free to perform other tasks. Additionally, the *EZSpice* also acts as a centralized container to store multiple seasonings, which help the user keep their kitchen neat and organized. Our company aims to design and produce an affordable, robust and easy-to-use device that provides convenience and assistance with seasonings in the kitchen for everyone.



Figure 2 - *EZSpice* Concept Model

Figure 2.1 shows the 3D concept model of the *EZSpice*. The device is 200mm wide and 300mm high. Inside the device, there are 6 seasoning containers; each has their own measuring mechanism at their individual exit. All exits shall funnel down the same dispensing area at the bottom of the device. The dispensing area is 150mm wide and 75mm high, hence a medium size bowl can fit into this area to collect the dispensed seasonings. At the front, there is a 7-inch touchscreen to take the customer manual input and a power button to turn the device on or off.



### *Requirements Specification for EZSpice*

Raspberry Pi 4 is chosen to be the central processor of the device system. The speech commands from the user will be picked up by a microphone connected to Raspberry Pi 4 via GPIO. Using Mozilla's DeepSpeech engine, the audio input will be converted to text for further analysis and processing in our software stack. After the process, the Raspberry Pi 4 will drive the motors under the corresponding containers to measure and dispense the correct amount as per user's request.

### 3. Requirements

This section specifies the general requirements of the EZSpice as a whole system, including its system requirements and functional requirements.

#### 3.1 System Requirements

The table below includes the system requirements for the *EZSpice* machine.

Requirement ID	Requirement Description
Req 3.1.1 C	The system will contain the following electrical component: a microcontroller, a microphone, a speaker, a power plug adapter, touch screen.
Req 3.1.2 C	The device must accept voice command as input.
Req 3.1.3 C	The device must provide audio feedback to the user's voice command.
Req 3.1.4 C	The device must be able to dispense seasoning.
Req 3.1.5 P	The device must contain at least 6 different spice containers.
Req 3.1.6 P	The device size and weight must be easy to carry and light.
Req 3.1.7 P	The device must be able to be fixed and not easily moved on the table.
Req 3.1.8 P	The device must have an input interface installed for manual selection and display.
Req 3.1.9 F	The device must be able to detect if the loading section is empty or has a container.

Table 3.1 - System Requirements and Progress

### **3.2 Functional Requirements**

The following table illustrates the functional requirements in a comprehensive manner.

<b>Requirement ID</b>	<b>Requirement Description</b>
Req 3.2.1 C	The device must have electricity power after plugging into a standard Canadian household electrical socket.
Req 3.2.2 C	The device must have a button for starting/shutting down.
Req 3.2.3 C	The device must be able to dispense seasoning accurately based on the request amount.
Req 3.2.4 P	The device must be able to change to manual mode if it cannot recognize the user's words.
Req 3.2.5 P	The device must be able to dispense seasonings with their unique outlet to avoid unwanted seasonings mixed into the predetermined seasonings mixture.
Req 3.2.6 P	The device must be able to give the correct seasoning types and their request amount based on the touch screen panel.
Req 3.2.7 P	The touch screen must be able to turn on after pushing the power up button.
Req 3.2.8 P	The screen must correctly display all the seasonings that exist in the machine.
Req 3.2.9 P	The touch interface must be able to input/select seasoning types and amount required through the display.
Req 3.2.10 F	The device must be able to notify the users if the requested spice was consumed completely.

Table 3.2 - Functional Requirements and Progress

## 4. Software Requirements

To fulfill real-time offline voice control requirements, open source speech recognition library DeepSpeech will be used to translate user voice input to text. Mozilla's DeepSpeech is one of the best offline speech recognition engines with pre-trained models. Based on a research article, DeepSpeech 0.6 can achieve speech-to-text with consistent low latency, compact model and fast start-up time on Raspberry Pi [1]. Considering the popularity, activeness and efficiency, Linux is chosen as operating system and Python is chosen as client language.

### 4.1 General Requirements

The table below shows the general requirements for the system of software.

Requirement ID	Requirement Description
Req 4.1.1 C	The software must be able to run on Linux OS.
Req 4.1.2 C	The software must have an interface to communicate with hardware.
Req 4.1.3 C	Speech recognition must be activated with wake-up words like "Hey, xxx" .
Req 4.1.4 C	The software must be able to process voice signals, extract spices or dishes keyword and output commands to hardware based on interface protocol.
Req 4.1.5 P	The software must be able to run on Raspberry Pi 4 with 2GB RAM and the model size must be able to fit in 16GB ROM.
Req 4.1.6 P	The software should be launched automatically after computer boots.
Req 4.1.7 P	The software must be able to self-recover from crashing.
Req 4.1.8 P	The software must inform the user if it can not recognize the speech and ask the user to try again.
Req 4.1.9 P	The software must be able to persistently store spice category and recipe.
Req 4.1.10 P	The software must handle error conditions and basic exceptions.
Req 4.1.11 P	The software must be able to control hardware to select correct spices and dispense precisely based on processed command input.

Table 4.1 - General Software Requirements and Progress

## 4.2 Speech Recognition Requirements

The table below shows the speech recognition software requirements for the system.

Requirement ID	Requirement Description
Req 4.2.1 C	The speech recognition software must be able to run offline.
Req 4.2.2 C	The speech recognition software must be able to translate English speech to text correctly.
Req 4.2.3 C	The speech recognition software must be able to recognize spices or dishes keywords with 80% success rate.

Table 4.2 - Speech Recognition Requirements and Progress

## 4.3 Performance

The table below shows the performance requirements for the software system.

Requirement ID	Requirement Description
Req 4.3.1 C	The speech recognition software must translate speech to text within 1.5 seconds delay.
Req 4.3.1 P	The system should respond to the user's command within 2 seconds.
Req 4.3.1 P	The system must boot up from cold start within 10 seconds.
Req 4.3.1 F	The program must recover from the crash within 5 seconds.

Table 4.3 - Software Performance Requirements and Progress

## 5. Hardware Requirements

The heart of this product is the hardware reaction based on the voice control analysis used to identify seasoning type and amount after the activation request. The hardware will make use of the motors, gears, and self-design 3d printing base and spice container. To meet the performance requirement, the machine will be using a wall plug as a power source. Motors and gears constitute the basic power for the operation of the *EZSpice* machine. Spice containers and their caps will be specially designed and 3d printed to ensure that they fit the machine we build and can accurately measure the amount of seasoning.

Raspberry Pi will be applied to collect and analyze the keywords. When the device is plugged into the power source and is in working condition, the machine will not actively collect keywords related to seasoning and dosage. The user needs to activate the speech detection and collection function through specific keywords.

Once the equipment collects the required seasoning type and amount. *EZSpice* will provide the required seasonings and their accurate amount.

### 5.1 Electronic Requirements

The table below shows the general requirements for the hardware system.

Requirement ID	Requirement Description
Req 5.1.1 C	Circuit protection for electrical components, motors, wires.
Req 5.1.2 C	Output signal must not exceed current limits of the Raspberry Pi GPIO pins.
Req 5.1.3 C	Raspberry Pi must have 2GB of RAM or more.
Req 5.1.4 C	Microphone must be able to record high quality audio that does not contain too much and interruption.
Req 5.1.5 C	The motor operation voltage must be less than 5 V.
Req 5.1.6 C	The motor must provide enough torque to rotate the valve for each spice container in order to dispense request seasoning.
Req 5.1.7 C	The motor turning speed must not be too fast to control the turning valve to let spice have enough time to dispense.
Req 5.1.8 C	The motor must be able to operate under 3A.

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Req 5.1.9 C	The thickness of the wires must be able to handle 3A current or higher.
Req 5.1.10 P	Circuit protection for Raspberry Pi, motors with enclosure.
Req 5.1.11 P	Wiring standards must be upheld.
Req 5.1.12 P	The protection case for electrical components must be big enough to put all the needed components in it.
Req 5.1.13 P	The speaker should be audible within the kitchen.
Req 5.1.14 P	The speaker's operation voltage must be able to be afforded by Raspberry Pi output voltage.
Req 5.1.15 P	The size of the motor must be fit into the protection case without occupying too much room.
Req 5.1.16 F	The motor must not be overbearingly loud.
Req 5.1.17 F	The motor must last for more than 2 years

Table 5.1 - Electrical Requirements for the hardware system

## 5.2 Mechanical Requirements

The table below shows the mechanical requirements for the hardware system.

Requirement ID	Requirement Description
Req 5.2.1 C	Spice dispensing gear system must give enough torque to run the spice container's valve while it is fully loaded.
Req 5.2.2 C	Spice containers must be able to dispense seasoning for users.
Req 5.2.3 C	Spice containers must be able to dispense the seasoning from its designated exit.
Req 5.2.4 C	Spice containers must be able to stop after dispensing the correct portion of the required seasoning.
Req 5.2.5 C	Spice containers must be able to let users refill their seasonings.
Req 5.2.6 P	Spice dispensing gear system must run continuously without making loud noises.
Req 5.2.7 P	Spice containers must not leak its seasoning at all times.
Req 5.2.8 P	Spice containers must let the users to pick up individually

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Req 5.2.9 P	Spice containers must let the users easily seal them after refilling.
Req 5.2.10 F	Spice containers must be able to be taken out and put back by users without instructions.

Table 5.2 - Mechanical Requirements for the hardware system

## **5.3 Power Source Requirements**

The table below shows the Power Source requirements for the hardware system.

<b>Requirement ID</b>	<b>Requirement Description</b>
Req 5.3.1 C	The supply circuit must supply a minimum 3A of current.
Req 5.3.2 C	The Raspberry Pi operation voltage must be between 5V and 3.3 V.
Req 5.3.3 C	The output voltage of the power supply must match the working voltage of the Raspberry pi and the motors.
Req 5.3.4 C	The output current of the power supply must be less than 3A.

Table 5.3 - Power Source Requirements for the hardware system



## 6. Engineering Standards

Since the *EZSpice* is to be sold in Canada, the product must comply to Canadian, and to some extent comply US and international, Laws and Standards. One of the most important aspects that the product must adhere to is the Food Safety. Furthermore, our product should also follow design standards that are environmentally friendly.

### 6.1 Electrical Standards

The table below shows the electrical standards that the system will follow.

Standard	Description
CAN/CSA C22.2 NO. 61508-1:17	Functional safety of electrical/electronic/programmable electronic safety related systems — Part 1: General Requirements [2].
CAN/CSA E60335-2-14-05 (R2018)	Household and Similar Electrical Appliances - Safety - Part 2.14: Particular Requirements for Kitchen Machines [3].
CSA C22.2 NO. 0:20	General requirements - Canadian Electrical Code, Part II [4].

Table 6.1 - Electrical Standards

### 6.2 Food Safety for Food Containers Standards

The table below shows the food safety for food containers standards that the system will follow.

Standard	Description
SOR/2018-108 Section 74.1	Food safety requirement for food storing to prevent cross-contamination of food [5].
CFR Title 21, Chapter 1, Part 177, Subpart B	Food safe material for basic components of single and repeated use food contact surfaces for Polymer material [6].
CFR Title 21, Chapter 1, Part 175, Subpart C	Food safe material as components of coating [7].
NSF/ANSI 51-2019	Requirements for materials used in the construction of commercial food equipment [8].

Table 6.2 - Food Safety for Containers Standards

### **6.3 Voice Recognition and Touch Display Standards**

The table below shows the voice recognition and touch display standards that the system will follow.

<b>Standard</b>	<b>Description</b>
CAN/CSA-ISO/IEC 30122-1:18	Information Technology - User Interfaces - Voice Commands - Part 1: Framework and General Guidances [9].
ISO/IEC 30122-2:2017	Information Technology - User Interfaces - Voice Commands - Part 2: Constructing and Testing [10].
IEC 62908-12-20:2019	Touch and Interactive Displays - Part 12-20: Measuring Methods of Touch Displays- Multi-touch Performance [11].

Table 6.3 - Voice Recognition and Touch Display Standards

### **6.4 Environmental Standards**

The table below shows the environmental standards that the system will follow.

<b>Standard</b>	<b>Description</b>
CAN/CSA-ISO/TR 14062-03 (R2013)	Environmental Management - Integrating Environmental Aspects into Product Design and Development (Adopted ISO/TR 14062:2002, first edition, 2002-11-01) [12].
CAN/CSA-ISO 14040-06 (R2016)	Environmental Management - Life Cycle Assessment - Principles and Framework (Adopted ISO 14040:2006, second edition, 2006-07-01) [13].

Table 6.4 - Environmental Standard

## 7. Sustainability and Safety

*EZSpice* comprises electronic circuitry while its containers of hardware will be used to collect seasoning powders or cooking sauces, which might cause electrical hazard potentially. Besides, the spice containers also involve food-safety issues which are worth discussing in the following table.

<b>Requirement ID</b>	<b>Requirement Description</b>
Req 7.1.1 P	The containers of the spices must be built with food-safe material.
Req 7.1.2 P	The electronics must be enclosed thoroughly (Containers of sauces must be isolated from the electronic components) and should not trigger an electrical hazard under normal operating conditions.
Req 7.1.3 P	The circuitry and the power plug shall not trigger an electrical hazard, fire or explosion under normal operation conditions.
Req 7.1.4 P	The valves of the containers must be closed firmly without leaking any spices while the machine is at idle state.
Req 7.1.5 P	The machine must not trigger electricity hazards while users are refilling the spice.
Req 7.1.6 F	The spice containers must be able to be uninstalled from the machine without triggering any electrical hazard.
Req 7.1.7 F	The spice containers must be able to be cleaned and reused.
Req 7.1.8 F	The circuitry must be isolated from the heat produced from the cooking environment and shall not overheat when the temperature is 50°C.
Req 7.1.9 F	The containers of the spices shall not be melted when the temperature is up to 50°C.
Req 7.1.10 F	The device shall be powered off safely under the conditions where any electronic components overheat.
Req 7.1.11 F	The package of the machine must follow the labelling standards as listed by ISO 28219:2017

Table 7.1 - Sustainability and Safety Requirements

## **8. Conclusion**

This requirement specification firstly introduced the background and the intended audience of *EZSpice* then demonstrated its system overview. Since the device will be composed of software and hardware systems. The requirements of these two systems were explained in detail with several subsections. Engineering Standards and Sustainability and Safety were also illustrated in this document. All the requirements were marked by a specific requirement ID with a clear phase of development label. Note that this document omits the design of the device.

Once more, our product *EZSpice*, a smart spice dispenser, will be designed to enhance the cooking experience for households, which will distribute the expected seasoning powder with desired amount. It will be assembled to a user-friendly, safe, and affordable machine.

Our diligent team will implement this product with good quality that meets all the requirements that have listed in this document.

## Reference

- [1]: Reuben Morais, DeepSpeech 0.6: Mozilla's Speech-to-Text Engine Gets Fast, Lean, and Ubiquitous, [Online],  
<https://hacks.mozilla.org/2019/12/deepspeech-0-6-mozillas-speech-to-text-engine/>
- [2] CSA Group, Functional safety of electrical/electronic/programmable electronic safety related systems - Part 1: General requirements, [Online], <https://www.scc.ca/en/standardsdb/standards/28870>
- [3] CSA Group, Household and Similar Electrical Appliances - Safety - Part 2.14: Particular Requirements for Kitchen Machines, [Online],  
[https://www.techstreet.com/standards/can-csa-e60335-2-14-05-r2018?product\\_id=1258105](https://www.techstreet.com/standards/can-csa-e60335-2-14-05-r2018?product_id=1258105)
- [4] CSA Group, General requirements - Canadian Electrical Code, Part II, [Online]  
<https://www.scc.ca/en/standardsdb/standards/30464>
- [5] Candian Minister of Justice, Safe Food for Canadians Regulations, Part 4, Division 4, Subdivision E, [Online],  
<https://laws-lois.justice.gc.ca/eng/regulations/SOR-2018-108/page-9.html#h-844336>
- [6] US Federal Government, Code of Federal Regulations, Title 21, Chapter 1, Subchapter B, Part 177, Subpart B: Substances for Use as Basic Components of Single and Repeated Use Food Contact Surfaces, [Online],  
<https://www.ecfr.gov/cgi-bin/text-idx?SID=85e30a3a75fc902bcb57ff365100d3f6&mc=true&node=sp21.3.177.b&rgn=div6>
- [7] US Federal Government, Code of Federal Regulations, Title 21, Chapter 1, Subchapter B, Part 175, Subpart C: Substances for Use as Basic Components of Single and Repeated Use Food Contact Surfaces, [Online],  
<https://www.ecfr.gov/cgi-bin/text-idx?SID=6d51b2aaed420a907726025424a53642&mc=true&node=sp21.3.175.c&rgn=div6>
- [8] NSF International, Food Equipment Materials, [Online],  
<https://webstore.ansi.org/Standards/NSF/NSFANSI512019>
- [9] CSA Group, Information Technology - User Interfaces - Voice Commands - Part 1: Framework and General Guidances, [Online], <https://www.scc.ca/en/standardsdb/standards/29373>
- [10] International Organization for Standardization/International Electrotechnical Commission, Information Technology - User Interfaces - Voice Commands - Part 2: Constructing and Testing, [Online], <https://www.iso.org/standard/63161.html>

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[11] International Electrotechnical Commission, Touch and Interactive Displays - Part 12-20: Measuring Methods of Touch Displays- Multi-touch Performance, [Online], <https://webstore.iec.ch/publication/31797>

[12] Canada National Standard/Canadian Standards - ISO TR, Environmental Management - Integrating Environmental Aspects into Product Design and Development (Adopted ISO/TR 14062:2002, first edition, 2002-11-01), [Online], <https://www.scc.ca/en/standardsdb/standards/19019>

[13] Canada National Standard/Canadian Standards - ISO, Environmental Management - Life Cycle Assessment - Principles and Framework (Adopted ISO 14040:2006, second edition, 2006-07-01), [Online], <https://www.scc.ca/en/standardsdb/standards/23295>

## Appendix A: Acceptance Test Plan

This acceptance testing aims at testing if the proof-of-concept prototype meets the requirement specification of alpha phase. It is also part of the development process which can help the development team to expose potential problems and improve the prototype with better design. In this acceptance test, the basic functionalities of the *EZSpice* dispenser will be tested as a prototype product.

The table below shows the acceptance test plan:

Test#: 1		
Pre-condition: N/A		
Procedure	Acceptance Requirement	Accepted if...
1	Tester powers up the device by plugging the power adapter into a standard house outlet and pressing the power button at the front of the device.	<ul style="list-style-type: none"> <li>• The device boots up immediately without any smoke or fire.</li> <li>• The speaker speaks a welcome speech to the user.</li> </ul>

Test#: 2		
Pre-condition: Have more than three teaspoons of salt in the corresponding container, database of the device has been correctly set up.		
Procedure	Acceptance Requirement	Accepted if...
1	Tester says “Hey, EZSpice” to the device.	<ul style="list-style-type: none"> <li>• The device is woken up and speaks “I am listening...”.</li> </ul>
2	Tester says “Dispense three teaspoons of salt”.	<ul style="list-style-type: none"> <li>• The device responds with “I am going to dispense three teaspoons of salt. Can you confirm?”.</li> </ul>
3	Tester says “Yes”.	<ul style="list-style-type: none"> <li>• The device responds with Ok” and dispenses precisely three teaspoons of salt into the dispense container.</li> </ul>

*Requirements Specification for EZSpice*

Test#: 3		
Pre-condition: Have all the required spices of egg fried rice in the corresponding containers, database of the device should have a recipe for egg fried rice.		
Procedure	Acceptance Requirement	Accepted if...
1	Tester says "Hey, EZSpice" to the device.	<ul style="list-style-type: none"> <li>The device is woken up and speaks "I am listening...".</li> </ul>
2	Tester says "I want to cook egg fried rice for two people".	<ul style="list-style-type: none"> <li>The device responds with "I am going to dispense spices of egg fried rice for two people. Can you confirm?".</li> </ul>
3	Tester says "Yes".	<ul style="list-style-type: none"> <li>The device responds with "Ok" and dispenses the correct amount of all required spices into the dispense container.</li> </ul>

Test#: 4		
Pre-condition: Database of the device has been correctly set up and "MSG" is not an entry in the database.		
Procedure	Acceptance Requirement	Accepted if...
1	Tester says "Hey, EZSpice" to the device.	<ul style="list-style-type: none"> <li>The device is woken up and speaks "I am listening...".</li> </ul>
2	Tester says "I want a teaspoon of MSG."	<ul style="list-style-type: none"> <li>The device responds with "MSG is not available."</li> </ul>