Bodacious Battle Bots

TECHINICAL

MANUAL

Technical Manual

Table of Contents

1. Programming Language….......//fix page #............GABI PLEASE DO THIS TOO.................................................2

**Programming Language and Structure of Files**

Programming Language

The programming language used throughout all the skills is JavaScript. Misty is capable of running only JavaScript and C#, we chose to use JavaScript since C# is still under development.

Structure of Files

The “root” directory is MistySkills. Inside there, there is a folder for every skill, and the name of the folder is the name of the skill.

Inside each folder of a skill, you will find at least three files. The source code, this file will have the .js extension. The JSON file, which will have the .json extension, this file holds the parameters needed for the skill, such as identifiers, variables, and instructions of how the robot should interact with that skill. Also, you will find a read.me, which gives a brief overview of the skill along with some details.

Some skills will have more than three files inside. These files are used during the skill and will only be images or audios.

Coding Practices

One of the most important coding practices involved in this project that is different than usual is the fact that if you want to use a function in a RegisterTimerEvent method, you will need to name as follow “ \_nameOfFuncion()” (underscore plus the name of your function).

Another important practice that in this project is different than others is how to declare global variables. In order to declare a global variable you will need to use misty.Set(), which takes three parameters, the first one is the name of the variable (string), the second one is the value, and the last one is if it should be kept after the skill is done. In order to access this variable, you will need to use misty.Get(), which requires only one argument, which is the name of the variable (string).

UML Use Case Diagram

Below is the Use case diagram. The operator of the Misty Robots will interact with the dashboard, which will then interact with the robot, and finally with the audience/other robot.

Diagram

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Class Diagram

Bellow, the class diagram with a more specific view of how the interactions are being done and expected for the project run smoothly.

Diagram

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**Brief introduction to skills**

Dancing  
In this skill, Misty moves its arms and head. It also turns around and plays an audio.   
  
Detecting Objects  
Misty starts to walk while it detects objects. It plays and audio when the object is found.  
  
Text to Sound  
The robot gets a string and uses an API to speak the text in the desired language.  
  
Sound to Text  
The robot hears a phrase and uses an API to turn that spoken phrase into text in the desired language.  
  
Conversation  
Misty answers to some audio inputs based on previously coded interactions.

Translation  
The robot hears a phrase, transforms it to a string, then translates the string to another language, and then gets the string and transforms it in audio. All that using APIs.

Tic-tac-toe  
NIKKO

Security Camera  
Misty starts streaming and it is possible to see the video streamed using a website.

Reaction  
Robot copies the arms movements that the person does, movements possible: arms up and down.

Face Recognition  
Misty recognizes faces and displays and audio each time it recognizes the person. The audio changes depending on the amount of interactions Misty had with that person.

Rock Paper Scissors  
The robot plays rock paper scissors.

Start with IP Address

This skill runs on startup. The only thing that it does is show the IP address of the robot on its screen once you tap on the robot’s chin.

**Special details of the skills code**

Dancing  
In this skill, Misty moves its arms, head. It also turns around and plays an audio.

We set Misty’s face to admiration, that we got from the Misty SDK website.

We created two functions to handle the arms movements. In these functions, we change the position of the arms.

In the head movement function, Misty turns its head left and right by us just changing the second parameter of the MoveHead() function.

In the turning function, Misty turns back and forth in a preset circle.

The most important part of this skill is handling the loops. Misty does not allow any kind of while loop inside her code. The way the robot uses loops is through registering an event to happen every X amount of time.

We used the RegisterTimerEvent to achieve that. This method needs 3 parameters: first, the name of the function (without the underscore) as a string, second, after how many milliseconds should it be triggered as an integer, and third, if it should repeat or not as a Boolean.

For this skill, there is nothing different in the JSON file from what the Misty SDK website generates.   
  
Detecting Objects  
In this skill misty will walk, avoiding hazards and when the object is found she plays an audio saying that the object was found./////////////////////need some space before next line but I forgot how to do it  
There are two major functions in this skill, the first one is \_object\_detection(). If the robot detects either a chair/laptop/cup/backpack it will stop moving and it will display a different “emotion” and play a different sound as a reaction of finding these objects.

The second major function is Hazard(). Misty starts the program driving, when there is something blocking its way, it triggers Misty’s sensors and gets data from each one of them. When at least one of the sensors is triggered because of an obstacle in the way, the robot tries to find a route without any hazards, changing the direction that the robot will drive next.

For this skill, there is nothing different in the JSON file from what the Misty SDK website generates.  
  
Text to Sound  
Straight forward skill, transforms a string into an audio that Misty will play.

We have 3 functions speakTheText, \_Base64In, and \_speakTheText.

The speakTheText method takes only one parameter. This parameter is a string and should be the text that you want Misty to Speak. Inside this method we have an important setup to do in order to run this skill. We have to use JSON.stringify() to make a string out of the arguments we need to use. These arguments are passed to the Google API which then sends us the audio response.

The most important parameters under the arguments are ‘input’, which should be the only parameter used in this method, ‘languageCode’, which is the language of the input, and ‘audioEncoding’, which should always be “LINEAR16” for the rest of the code to work.

After setting up, you can then use SendExternalRequest to talk to the Google API.

The \_Base64In function is where the Google API talks to misty and saves the audio file, then plays it. This method needs to start with an underscore, because it is being called from SendExternalRequest and getting data from it.

The \_speakTheText function is only to allow the Google API to talk to misty, by registering an event that misty will be waiting before running the rest.

Our JSON file in this skill plays a very important part and have a different set up. Inside the “parameters”, there is a variable called "APIKEY\_Google" which is followed by a colon and then a string. This string is the key that you should get from google. Explanation on how to get this key is under “Installation and Requirements to work with This Project”.  
  
Sound to Text

Record an audio, then displays it on Misty’s screen.

There are 2 functions that we created \_voice\_record\_complete\_message and register\_voice\_record\_complete.

In order to accomplish this task, we used the built-in function CaptureSpeechGoogle. Which takes the following parameters: overwriteExisting(which should always be false), silenceTimeout(how long should Misty wait without hearing anything before it moves on), maxSpeechLength(how long should it record if the silenceTimeout does not stop it), requireKeyPhrase (if misty should wait for a “Hey, Misty” before it starts recording), captureFile(should always be true), speechRecognitionLanguage (the language that she is going to hear in language code), key (Google API key, that should be inside JSON file).

Since the Google API will return a lot of data, we need to specify what we want to use. For this, we used the register\_voice\_record\_complete function. Which add the proper return cases that we should look from the API, then register the event voice\_record\_complete\_message.

The \_voice\_record\_complete\_message is an event; therefore it needs to begin with an underscore. Inside, we just call built in functions to display the proper results.

Our JSON file in this skill plays a very important part and have a different set up. Inside the “parameters”, there is a variable called "APIKEY\_Google" which is followed by a colon and then a string. This string is the key that you should get from google. Explanation on how to get this key is under “Installation and Requirements to work with This Project”.  
  
  
Conversation  
NIKKO

Translation  
This skill is an applied use of two skills defined before, Sound To Text and Text To Sound. The translation part is the middle of the skill. For understanding of the other parts used, please read the documentation for the other two skills.

The translation part uses only two functions: \_translatedData and translateText.

Our translateText function needs only one parameter, which is a string representing the text that you want to translate. Inside this function, you will need to set up the variable arguments. It is important to change the “source” and “target” based on the languages that you want to translate from and to. Then, we use the SendExternalRequest function to call the Google API, and set our last argument to the event in which the return values should be sent to, in this case \_translatedData.

The \_translatedData function will get the return value from the Google API as its only parameter. Then, it will save to a variable that can be accessed from other functions.

Our JSON file in this skill plays a very important part and have a different set up. Inside the “parameters”, there are three variables called: "APIKEY\_GoogleSTT", "APIKEY\_GoogleTTS", and "APIKEY\_GoogleTranslate” which are followed by a colon and then a string. These strings are the keys that you should get from google. Each key should be entered with the service that you want to access. Explanation on how to get this key is under “Installation and Requirements to work with This Project”.

Tic-tac-toe  
NIKKO

Security Camera  
Misty calls a method that starts the video streaming, after that the user opens the website: <http://sdk.mistyrobotics.com/stem/senses.html>. It is possible to see through misty what is happening in the room (within Misty’s camera range). Then we call another method to be able to cancel the video streaming.

For this skill, there is nothing different in the JSON file from what the Misty SDK website generates.   
  
Reaction  
Misty identifies a human, then it tries to do an estimative of which pose the person is, then reacts to that.

The most important part of this skill is the \_human\_pose\_estimation. All the interactions that the Robot will perform is inside this method. Everything else is setting up the robot and allowing it to a lot of math and statistics to perform the pose estimation. It is highly advised to not change anything that is not inside the \_human\_pose\_estimation method.

In this skill, the human body is defined as follow:

NOSE(0), LEFT\_EYE(1), RIGHT\_EYE(2), LEFT\_EAR(3), RIGHT\_EAR(4), LEFT\_SHOULDER(5), RIGHT\_SHOULDER(6), LEFT\_ELBOW(7), RIGHT\_ELBOW(8), LEFT\_WRIST(9), RIGHT\_WRIST(10), LEFT\_HIP(11), RIGHT\_HIP(12), LEFT\_KNEE(13), RIGHT\_KNEE(14), LEFT\_ANKLE(15), and RIGHT\_ANKLE(16).

The only parameter that the \_human\_pose\_estimation takes is a return value from an event. Then, we will store the key points from the human that misty was able to detect inside an array. From there, we try to estimate the pose based on the key points and define an action for misty based on what she saw.

In the JSON file, the only thing that needs to be changed from the generated template in the Misty SDK website is to add an argument called "SkillStorageLifetime" and set its value to "LongTerm". Since we will need to have access to global variables through the code.

Face Recognition  
Misty recognizes faces and then reacts differently to each person it recognizes.

The most important function is the \_FaceRec(). In this function, Misty checks who is that face detected. After that, Misty displays an expression of joy, and depending on the number of times the robot has seen that person, a different image and phrase is displayed by the robot.

In the JSON file, the only thing that needs to be changed from the generated template in the Misty SDK website is to add an argument called "SkillStorageLifetime" and set its value to "LongTerm". Since we will need to have access to global variables through the code.

Rock Paper Scissors  
In this skill, Misty plays rock paper scissors. There are two options: play against human, play against another Misty.

At the moment, the most important function is the \_PlayWithHuman(). In this function, we get a random number. Then the robot displays a countdown before starting the game.

After that, Misty displays its choice randomly. The face is reset to an expression and the game starts all over again.

For this skill, there is nothing different in the JSON file from what the Misty SDK website generates.

Start with IP Address

The only thing that this skill does is show the IP address of the robot on its screen once you tap on the robot’s chin.

We have only 3 functions in this skill. \_Touched, toggleIPLayer, and \_GetDeviceInformation.

The \_Touched function simply checks if the chin of the robot was touched and reacts accordingly.

The toggleIPLayer function is used to configure the display of text in the robot’s screen.

Lastly, the \_GetDeviceInformation is used to actually show the IP in the robot’s screen.

In the JSON file, the only thing that needs to be changed from the generated template in the Misty SDK website is to add a string inside the “StartupRules” called “Startup” right after the “Robot”. Be sure to also add a comma to separate the string. Since we will need to start the skill whenever the robot turns on.

**Installation and Requirements to Work With This Project**

How to get Google API keys

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1. Access <https://cloud.google.com/apis> and select the view API manager button.

Graphical user interface, application, email

Description automatically generated

2. Select tab to the top left portion of the page directly to the left of Google Cloud Platform.

Graphical user interface, text, application

Description automatically generated

3. After you select the project tab you will see all your current projects. You may start new project by clicking the new project option to the top right of select a project.

Graphical user interface, text, application, email

Description automatically generated

4. Input a project name of your choice then click create. You will then be redirected to the project page and most likely receive notification that it was successfully created.

Graphical user interface, application, Word

Description automatically generated

5. Now you will want to search for the API you want to work with. (Above photo)

Graphical user interface, text, application, email

Description automatically generated

Here we selected text-to-speech and speech-to-text APIs.

Graphical user interface, text, application, chat or text message

Description automatically generated

6. Proceed to click enable. You will need to set up a payment plan if you don’t already have a card on file. When you first sign up there is a trial you may use to your advantage. You may look over pricing options and packages, documentation, and support for the selected API.

Graphical user interface, text, application, email

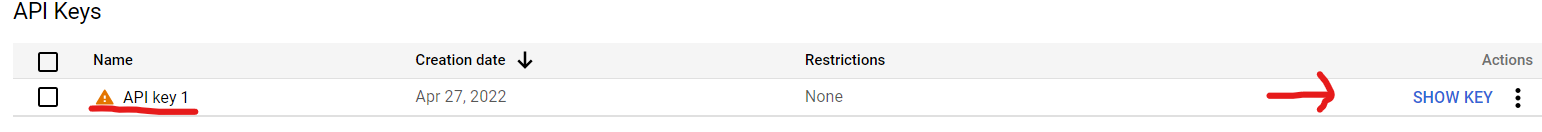
Description automatically generated

7. After you enable the API, you will be sent here. In order to use the API you enabled, you must create an API key that coincides with it. Select the credentials option under APIs and Services.

Graphical user interface, text, application, email

Description automatically generated

8. From the credentials page click + Create Credentials and select the API Key.

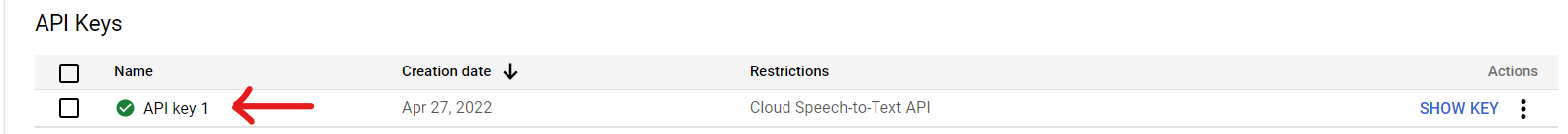


9. After you create the key, you will be sent back to the credentials page where you will see your newly generated API key. Click on the API key 1 because you need to set a restriction.

Graphical user interface, text, application, email

Description automatically generated

10. From here you may set restrictions as you please, but our team simply set a restriction under API restrictions then selected the Speech-To-Text API through the drop down and click save.



After saving the restriction for you API key, you will be sent back to its front page. Here you will notice a green checkmark next to the API key. Your key is now protected by restrictions. You may also copy your key to clipboard by first accessing your key through show key.

You may now place this API key in your JSON to use with you skills. (Check technical manual for guidance on where to place your keys.)

Getting Our Code from GitHub

In order to get access to the source code of this project, please go to the following link:

<https://github.com/HMedeirosDosReis/MistySkills>

A screenshot of a computer

Description automatically generated



Then click the green Code button:

A screenshot of a computer

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Click on Download ZIP and place it on your preferred directory.

Extract the folder. Then you will be able to see and edit the code.