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Speech recognition tutorial

Speech recognition is becoming a very popular way to control robots. This tutorial will explain the EZ-Builder speech recognition control in detail, and go through the the steps of how to set it up. It will also include further information such as explaining the controls, training Windows Speech Recognition, and general information on using speech recognition successfully.

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Step 1. Loading the Speech Recognition Control.

This entire tutorial accompanies the tutorial found here, but will go in to detail showing ways of how to use the speech recognition control, along with working examples that you can try. To get started, we first need to add the "Speech Recognition Control" to your EZ-Builder project.

1.) On your computer, load up the most recent release of the EZ Builder software.
2.) Click on the "**Project**" tab from the EZ-Builder menu ribbon.

3.) Now click on the "**Add Controls**" tab.

4.) Select the "**Audio**" category tab and then click on the "**Speech Recognition**" icon to add this control to your EZ Builder project.

The next step will explain the what each command setting in the "Speech Recognition Control" does.

Step 2. Explanation of the Speech Recognition Settings.

Confidence.

This is a drop down menu that contains different values for adjusting the ability of the computer to better understand what is being said, and match the correct words/phrases spoken by the user. When your computer hears a word or phrase spoken by a user, it will try to correctly match what is said with it's speech recognition library.
The upside to having this setting set to a low number will more easily hear what is said and will try to match it. The down side is that more false positives will occur, meaning it has more chance of misunderstanding what was said.
The upside to having the confidence level set to a high number will reduce the false positives that can be heard and will result in far better accuracy. The down side however, is that there may be times that even if something is correctly, the computer thinks it has misheard you and nothing will happen. There is more information on this in the next step.
Setup Microphone.

This tab takes you to the microphone settings on your computer. For improved speech recognition accuracy, these settings may need to be adjusted. To do so, start by clicking on "**Setup Microphone**", then double click on the microphone you wish to use for recognition, then select "**Levels**" and adjust the microphones volume and sensitivity settings.
An important thing to consider when using speech recognition, is the quality of microphone used. The is more information on this in the last step of this tutorial.
All Recognized.

This is where you can add a single line of script by clicking on the text input box, or a multiline script by clicking on the "pencil" icon. Now, every time any high confidence phrase is heard, this script will run, but will not run on any low confidence phrases.
Low Confidence.

Similar to above, any single or multilined script added here will be triggered when a low confidence phrase is heard.
Enable Phrase.

This is a single phrase spoken by the user that will unpause the speech recognition control. When the control is unpaused, the computer is listening for your commands. Simple click on the text input field, and write in whatever phrase you wish to use, for example... "hello robot".
NB: Any text entered here does not need any punctuation or capital letters.
Enable Cmd.

This is where you can add a single line of script by clicking on the text input box, or a multiline script by clicking on the "pencil" icon. When the "Enable Phrase" is recognized, this script will run.
Disable Phrase.

This is a single phrase spoken by the user that will pause the speech recognition control. When the control is paused, the computer stops listening for your commands. Simple click on the text input field, and write in whatever phrase you wish to use, for example... "robot stop listening".
NB: Any text entered here does not need any punctuation or capital letters.
Disable Cmd.

This is where you can add a single line of script by clicking on the text input box, or a multiline script by clicking on the "pencil" icon. When the "Disable Phrase" is recognized, this script will run.
Language.

This is where you can choose your desired speaking language to be used with speech recognition, as long as you have the proper language culture installed on your Windows machine and is correctly set up.
Confidence.

This is a variable where the last recognized phrase confidence level will be stored, and can be used in other scripts in your project.
Phrase.

This variable is where all of the phrases that are in your speech recognition control are stored, no matter what the confidence levels are, and can be used in other scripts
The "Phrase" List.

This is where you add the words or phrases to be spoken by you or other users. The phrase list comes preset with some basic phrases and commands which can be used as is, edited, deleted or added to, As an example, you can write... **hello robot**.
NB: Any text entered here does not need any punctuation or capital letters.
The "Command" List.

This is where you can add a single line of script by clicking on the text input box, or a multiline script by clicking on the "pencil" icon. When the Phrase to the left of this command is recognized, this script will run. As in our example above, you can add the following script...

```
Say ("Hello human. It is nice to see you.")
```

Once this is saved, with the speech recognition control unpaused, you can say "Hello Robot", and if the confidence level is met, your computer will respond with "Hello human. It is nice to see you."
On thing to note, if you use any **Say("")** commands, unlike the "phrase" lists, you must use punctuation and capital letters where appropriate, otherwise your computer or robot will not speak correctly and you may receive errors.
Phrase/Command Editor Tools.

On the bottom or the speech recognition configuration menu. you will see the following selections...
Move Up: Click to highlight the "Phrase", then click on "Move up" to move the line up.
Move Down: Click to highlight the "Phrase", then click on "Move up" to move the line down.
Delete Row: Click to highlight the "Phrase", then click on "Delete" to delete the line (this will delete any scripts saved in the the phrase line too".
Insert Row: Click to highlight the "Phrase", then click on "Insert Row" to add a new phrase/command line above the one you highlighted.
Append Row: Click on "Append Row" to add a new line to the end of the phrase/command list.
Save: Saves any recent changes made to the control editor.
Cancel: Cancels any recent changes made to the control editor
The next step will explain a little more about speech recognition confidence levels.

Step 3. Speech Confidence Levels.

The "Confidence" level setting in the speech recognition control is quite an important aspect for using the control successfully, and some fine tuning may be required to get the best results in certain situations.
When using speech recognition, you may get a message saying "Low Confidence" in the debug window of the speech recognition control. In this case, if EZ-Builder thinks it hears you say something but it's not to clear, EZ-Builder will say for example...
Quote:
Low confidence: (
what the computer thinks it heard
) (0.35)
but it won't play the script mapped to that phrase, even if that phrase is correct. If your computer thinks it hears you clearly, you won't get the "Low confidence" message in the debug window and you will only see the phrase you just spoke. Also, setting the confidence levels too low can cause many false positives, meaning you can say one phrase, and the computer thinks you said something else. Something to keep in mind if you control a robots movement with speech.
What you can do in either instance, is open the config setting menu (small gear icon) on the speech recognition control, and at the top left of the settings page you will see a drop down menu where you can change the confidence levels. Change it to a lower or higher number, save it, and try again. Basically, what is needed is for the confidence level number of your spoken phrase to be equal or higher than what the level is set to within the speech recognition menu.

Also something to keep in mind is using a good quality speech recognition microphone, setting your microphone levels within Windows (also can be accessed via the speech recognition menu mentioned above), and to train your computers speech recognition to better understand you.
Finally, background noise. Things such as a TV or radio on in the background, or other people talking in the same room can all effect the quality of speech recognition, but adjusting the confidence levels can sometimes help.
The next step will explain a couple of ways on how to train you computer to better understand you when using speech recognition. If you already know how to do this, you can skip to step 5.

Step 4. Setting up your microphone.

Before you can use the "Speech Recognition" control with any success, you may need to set up the microphone you are going to use.
First, you will need to check the microphone levels so your computer can hear you clearly.
1.) Click on the microphone you are going to use, then click on 2**Properties**".

2.) Click on the "**Levels**" tab), then adjust the microphone levels using the slider controls (Highlighted blue in screen shot). Then click "**Save**".

Next, you will need to use the microphone setup wizard.
1.) Either right click the speaker icon in your taskbar on your desktop then click on "**Recording devices**", or click on the "**Setup Microphone**" tab in the EZ-Builder "Speech Recognition" configuration menu.

2.) Click once on the microphone you wish to set up, then click "**Configure**. Then click on "**Set up microphone**".

3.) Now choose the type of microphone you are using, then click "**Next**". On the next page, follow the on-screen instructions, and click "**Next**".

4.) Again, follow the on-screen instructions to verbally set up your microphone.

5.) When the setup is successful, the "**Next**" tab will highlight. Click on it, and in the following window, click "**Finish**".

Now your microphone is set up, you can proceed to use voice recognition. The next step explains how to train "Windows Speech Recognition"

Step 5. Windows Speech Recognition Training.

Supported languages for Windows 8.1 Speech Recognition are as follows...
English United Kingdom,
English United States,
German French,
Spanish,
Japanese,
Mandarin (Chinese Simplified),
Mandarin (Chinese Traditional).
Now, we will go through a step by step guide for setting up and training Windows Speech Recognition.
1.) Open your computers **"Control Panel"**, then click on **"Speech Recognition"**.

2.) Click on *"Train your computer to better understand you"*. This will now open the Speech Recognition Voice Training wizard.

3.) Click on **"Next"**, then read the sentence that is shown on screen which will be... *"I am now speaking to my computer"*.

4.) Follow the on-screen instructions to complete the speech recognition training session. The "Training Wizard", will guide you through some tasks that are designed to help your computer hear how you say the commands available through Speech Recognition.

There is also some further custom training you can do, such as an extended training session that you can select. You can also add words or phrases directly in to the speech recognition dictionary, which helps your computer understand words or phrases which it may have difficulty understanding.
1.) Open up the **"Speech Recognition"** program.

2.) Say **"Open Speech Dictionary"** OR Right-click on Speech Recognition Bar.

3.) Click on **"Open the Speech Dictionary"**. Click on or say **"Add a new word"**.

4.) Type in the word or phrase you want to train. Then click on **"Next"**.

5.) Check the **"Record a pronunciation upon Finish"** box. Then click "**Finish**".

6.) Make sure speech recognition bar says **"Listening"**.

7.) Click the **"Record"** button.

If the word or phrase was successfully recognized, you will see a message saying "*Recording was successful*".
8.) If you want to add more words or phrases, check the **"I want to make more modifications to the Speech Dictionary upon Finish"** box. Then click on **"Finish"**.

Step 6. Changing language for Windows 7 Home Premium.

The following information is from a forum members thread asking how to change the language from Dutch to English for speech recognition on a Windows 7 Home Premium computer. This will work on other languages too, so you may find the following information useful.

1.) Go to "**Control panel**".

2.) Then click on "**Speech recognition**".

3.) And then "**Advanced speech options**".

4.) Then click on the drop down menu in "**Language**".

Apparently, sometimes the "Advanced speech options" tab is not available, so the following info may be of use...
m.dummies.com/how-to/content/how-to-change-windows-7s-speech-recognition-settin.html
https://www.sevenforums.com/general-discussion/112035-solved-change-language-windows-7-home-premium-oem-spanish-english.html
There are also a few YouTube videos that show how to do this as well, if you type in "*How to change language in Windows 7 Home Premium*" you should get a few results back and might be worth checking out.

Step 7. Pausing and Unpausing Speech Recognition.

As well as the "Disable Speech" phrase and commands, there is a manual pause check box found on the speech recognition control window, which when ticked, pauses the control. The computer will still hear unconfident phrases (if selected), but no confident phrases or scripts will be heard or run.

Some users have encountered a problem when the control is unpaused, for example, using the "Enable Phrase" option. The issue these members faced, was when the control is permanently unpaused, the computer or robot talks, but it tends to hear itself speak and activates commands depending on confidence levels. This can sometimes be quite amusing seeing a robot take on a mind of it's own, but sometimes it can be a pain. So how do you stop this from happening?
A.) Adjust the confidence levels in the speech recognition configuration menu, although this may not always have the desired effect.
B.) A much more reliable way of doing this, is to pause the control while the computer/ robot speaks. If you have a speech script like the following...

```
Say("Hello. I am a robot, and I am having a good day.")
```

you can add a cheat sheet command to pause the control while the computer/robot speaks, and then unpauses the control when it finishes speaking.

```
ControlCommand("Speech Recognition", PauseOn)
SayWait("Hello. I am a robot, and I am having a good day.")
ControlCommand("Speech Recognition", PauseOff)
```

1.) To do this, simply open the speech recognition configuration menu,
2.) Click on the "pencil" icon for the phrase/command that needs to be changed,
3.) In the script editor, right click your mouse/trackpad and click on the "Speech Recognition" cheat sheet command to expand it.
4.) Select "**ControlCommand("Speech Recognition", PauseOn)**", and make this the first line of the script,

5.) Then right click again, select "**ControlCommand("Speech Recognition", PauseOff)**, and make this on the last line of the script.

6.) The final change is to change your "**Say()**" or "**SayEZB()**" commands to "**SayWait()**" or "**SayEZBWait()**". This will allow the computer or robot to say the entire sentence, then unpause the recognition.
7.) Save these changes, and now your computer or your robot will no longer hear itself say this phrase.
Other cheat sheet options for pausing and unpausing the control, is **ControlCommand("Speech Recognition", PauseMS, PauseMS [ms])** where you can set an amount of time to pause the control before it unpauses itself...

```
#This pauses the control for 5 seconds.
ControlCommand("Speech Recognition", PauseMS, 5000)
```

```

And the cheat sheet command **ControlCommand("Speech Recognition", PauseToggle)** switches the pause control between On and Off when this command is run.
Don't forget, you don't have to right click to find the cheat sheet commands, you can also find them under the "**Cheat Sheet**" tab in the script editor.
```

Step 8. Example Script for using Speech Recognition.

There are some Speech Recognition examples that can be found within EZ Builder itself. These show different ways to use the speech recognition control. To find these examples...
1.) Open up EZ-Builder.
2.) With the "**File**" tab clicked in the menu ribbon, click on "**Open**".

3.) Then click on "**Examples**".

4.) Double click on "**EZ-Script Examples**" and search through the projects related to Speech Recognition, and click "**Open**" to open the project example on EZ Builder.

Below, is an example you can use that uses the basics of the speech recognition control, which plays the game "*Rock, Paper, Scissors*".
1) Add a "**Speech Synthesis"** control to an EZ-Builder project.Then set the voice you wish to use.
2) Then add a "**Speech Recognition**" control.
3) In the "Speech Recognition" control, you will need to add 4 new phrases and commands. Open the configuration menu (gear icon) on the speech rec control and type the in four new phrases in the "Phrase" list as follows...
lets play rock paper scissors
rock
paper
scissors
4) In the first phrase line, click on the little pencil icon on the "Command" line to the left of the phrase, add the following script...

```
ControlCommand("Speech Recognition", PauseOn)
sleep(1000)
saywait("Okay then. That sounds like fun. You start.")
ControlCommand("Speech Recognition", PauseOff)
```

5) In the second phrase line, "Rock", click on the "Command" pencil icon and add...

```
#rock
ControlCommand("Speech Recognition", PauseOn)
$rock = GetRandom(0,2)
if($rock = 0)
sleep(1000)
Saywait("Rock. That is a tie. Let's try that again.")
elseif($rock = 1)
sleep(1000)
Saywait("Paper. Paper, wraps Rock. So, I win.")
elseif($rock = 2)
sleep(1000)
Saywait("Scissors. Rock, blunts Scissors. Well done. You win.")
endif
sleep(2000)
ControlCommand("Speech Recognition", PauseOff)
```

```

**6)** Then in the "Paper" phrase line...

```
#paper
ControlCommand("Speech Recognition", PauseOn)
$paper = GetRandom(0,2)
if($paper = 0)
sleep(1000)
Saywait("Rock. Paper, wraps Rock. You are good at this. Well done.")
elseif($paper = 1)
sleep(1000)
Saywait("I guessed paper too. That makes it a tie. Let's try again.")
elseif($paper = 2)
sleep(1000)
Saywait("Scissors. Scissors, cut Paper, so, I beat you that time. Unlucky.")
endif
sleep(2000)
ControlCommand("Speech Recognition", PauseOff)
```

**7)** And finally, the  "Scissors" phrase line...

```
#scissors
ControlCommand("Speech Recognition", PauseOn)
$scissors = GetRandom(0,2)
if($scissors = 0)
sleep(1000)
Saywait("Rock. Rock, blunts Scissors. I win. You are not very good at this.")
elseif($scissors = 1)
sleep(1000)
Saywait("Paper. Scissors, cut Paper. Nicely played. Let's try again.")
elseif($scissors = 2)
sleep(1000)
Saywait("Scissors. That makes it a tie breaker. Let's see if we can do better.")
endif
sleep(2000)
ControlCommand("Speech Recognition", PauseOff)
```

8) Now Click "**Save**" to save the changes made in the speech recognition control.
9) Now plug in your headset or microphone and say to your robot "Lets play rock, Paper, Scissors.", and enjoy the game.
For more information on adding to the scripts above, click the link below for more details.
SpeechRecognition games
Enjoy.
```

Step 9. Additional information on getting the best out of Speech Recognition.

The following, is an answer I gave to forum member asking questions about speech recognition which you may find useful.
There are some important points for successful speech recognition, not just with EZ-Builder, but in general use. These are...

Type of S/R microphones

Using a good quality microphone, preferably one designed for speech recognition, such as wired headset or Bluetooth microphones, which in your case would not be practical. (*Forum member was thinking of an onboard microphone*).

Software

Windows speech recognition software needs training, a LOT of training to get any decent results.
Quote:
I'm interested in having a microphone within the robot itself so I, and others can communicate with it away from my computer
Another thing to remember is this software really only recognizes the voice of the person who trained it. For it to recognize other users, you would need to create a new voice profile for these other users to get more accurate results.
Using the speech recognition control in EZ Builder will yield better results than say using the Pandorabot control, as it is only listen for a particular set of words or phrase you have added in to the "Speak Phrase" list, where as the Pandorabot control is listening to anything being said and try's to match it with its library.
Something that would help with distant recognition accuracy is to use something better than Windows, which would be something like Dragon Natural Speaking software, but unfortunately it cannot be used with EZ Builder due to the expense of the DNS SDK.

EDIT:

There are new controls and plugins now available in EZ-Builder such as “Bing” and “Google” Speech Recognition which work really well and do not require computer voice recognition training.

Distant Speech Microphones

Quote:
is it feasible as to the computer being able to discern what is being spoken due to the fact that you are not speaking directly into a microphone
This is based on the microphone used, and not so much the computer listening.
Microphones designed for distant recognition is still a relatively new technology, and distant speech microphones (DSR microphones) are few and far between at the moment, especially wireless ones. One such wired microphone that is used for VoIP conference calling is the Voice Tracker 1 that connects to a computer using a microphone socket, and the Voice Tracker 2 that connects via USB or mic socket, both of which use beam forming technology to hear voices from across a room which is geared towards speech recognition as well. I haven't tried the voice tracker mics yet as there are a bit out of my price range for something to try, but the reviews that are around are generally pretty good.
Another type of distance speech rec microphone, are digital array mics such as the DA-350 and the CrispMic that connects via USB which I have used on a computer in the same room as the robot, with fairly good results, and are small enough to put inside of a robot with an on-board PC or using an external PC with the mic in the same room as the robot.
Quote:
as respects what hardware was used and how it is connected to their computer, i.e WiFi Bluetooth or what?
Below are a couple more links to mics that other members have used with speech recognition..
X tag wireless

Snowball USB
Koss CS-100 headset Microphone jack
Here is a discussion I started a while back asking about speech recognition microphones..,
www.ez-robot.com/Community/Forum/Thread?threadId=5982
And another discussion from @Steve **Neal**..,
www.ez-robot.com/Community/Forum/Thread?threadId=8073
Quote:
Microphone in Robot.
So in a nutshell, there are only very few distant speech recognition microphones available that would work well in a robot, but are pricey and not wireless at the moment (at least I have not come across one yet). If you google DRS (distant speech recognition) you will however find a lot of documentation on the subject. To have what you're asking would a lot of the time require a computer on-board a robot, but solutions such as wireless and Bluetooth microphones are also an option, but not very good at picking up speech from a distance. A microphone array connected to a computer that would be in the same room as the robot is another option (although the mics not in the robot). But for an affordable high accuracy wireless or Bluetooth speech rec mic, it would have to be worn by the user. I had a play about with a pair of Apple Ear-pods that come with an iPhone, plugged in to a laptops mic socket, and believe it or not I got some great results using the speech recognition control with fairly accurate results up to 5 feet away from my mouth in a quiet room. The videos I posted in this EZ Builder games thread used this.
And to finish off, with any hardware used for speech recognition, quality of hardware (normally more expensive) and software training pays off. Here's hoping one day the EZ-B v5 will have an on-board microphone or socket to connect a mic to, not just for recognition, but for streaming any audio. That being said, it must be noted that onboard microphones (microphones installed in/on a robot) can have its own issues. Noise from the robot, (drive motors, servos etc), can interfere with recognition causing phrases not to be heard or cause false positives (robot noises can be interpreted as phrases and the robot would do thinks you don’t want it to)
At the end of the day, I think many of us here are looking for a highly accurate, affordable, easy to set up, and dynamic use (other users speech can be recognized) to do exactly what we are looking for, with the three important factors... accuracy, talking at a distance, and for other people to be understood, not just the user.
Happy building.
[b]Tutorial created on 3rd October 2015
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