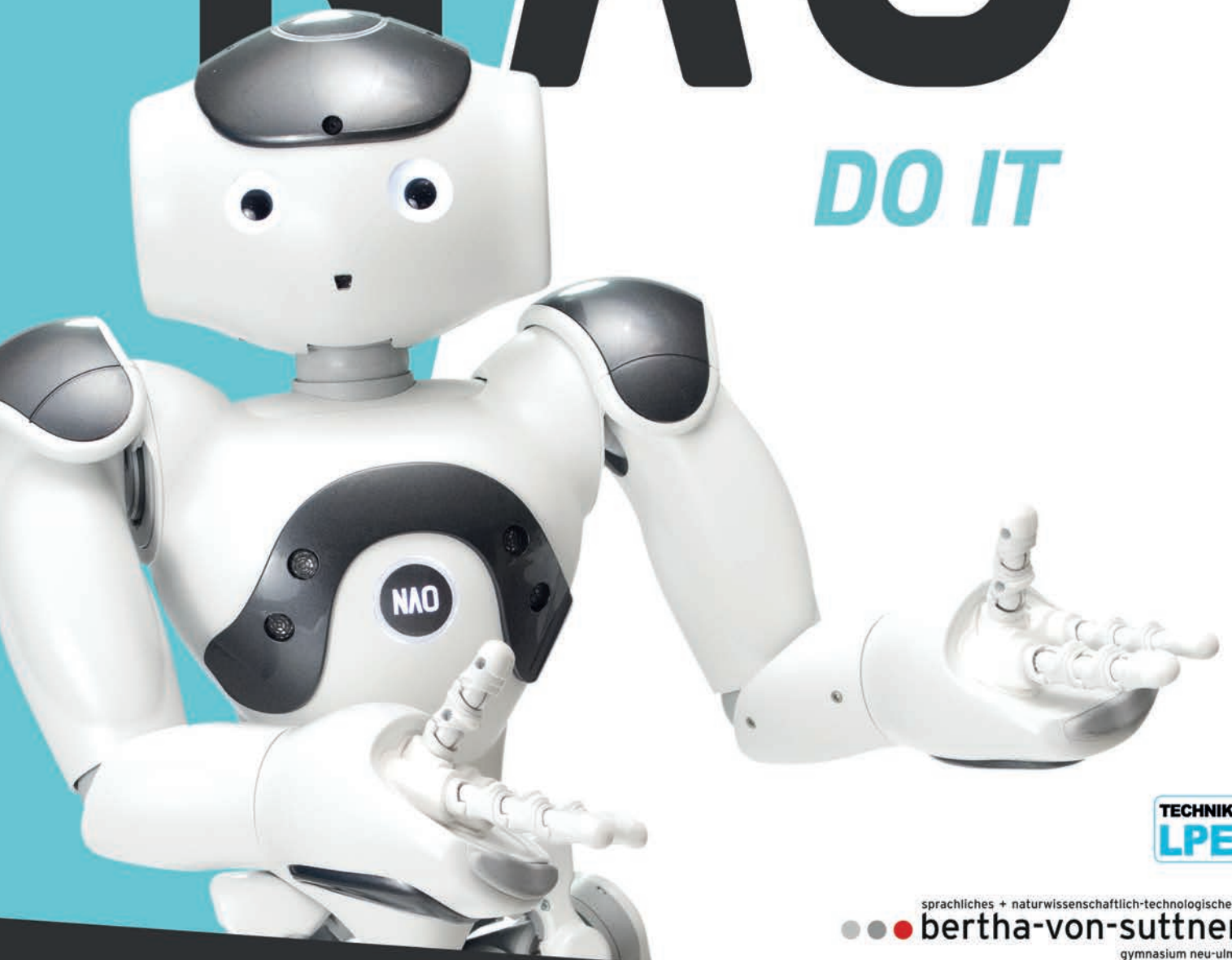


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Direction: H.Schnaubelt

 SoftBank
Robotics

NAO⁶

DO IT



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CREATIVE PROJECT IDEAS

Do it NAO⁶ - Creative Project Ideas

1st edition 2019

All prints of this edition are unchanged and can be used in lessons or privately in parallel.

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All program examples and screenshots for NAO⁶ were tested and taken in the environment Choregraphe (Version 2.8.X).

It is possible to transfer the content to earlier NAO generations, however their correct functioning cannot be guaranteed. The same applies the other way around.

In this book, "NAO" always refers to the sixth generation of NAO.



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We,
the team of authors comprised of **Kai Anter**, **Marcel Greiner**, **Jonas Vatter**, and **Jannes Weghake**, under the direction of **Heike Schnaubelt (OStRin)**, are pleased to present our book "Do it NAO⁶ - Creative Project Ideas".

It was created as part of our study skills seminar "The real and virtual STEM classroom of the future" in cooperation with the company **Technik-LPE GmbH**.

Our target group:

Anyone who is interested – anyone at all!

We have set ourselves the following goals for the book:

- NAO⁶ is intended as an ideal introduction to humanoid robotics.
- This book, NAO⁶ with a laptop/notebook, and the required materials are all you need to put the creative project ideas into practice.
- We want to encourage independent and structured work on creative project ideas in the STEM field.

We will achieve these goals through:

- Clear illustrations
- Step-by-step instructions
- Practical exercises with suggested solutions



Together with this book you will receive a link to our virtual archive from Technik-LPE GmbH. This contains all material templates and suggested solutions for all the projects.

We hope we can inspire you to explore this new universe and that this book will be of help to you in doing so.

Have fun discovering this new NAO-verse!

Neu-Ulm, April 2019

Your author team

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Idea	Application	Time	Difficulty	Chapter
NAO shopping	NAO as a sales assistant	Short	Easy	1
	NAO as a shopping helper	Long	Advanced	12
	NAO goes shopping	Medium	Extreme	17
NAO as teacher	NAO recognizes famous faces	Short	Easy	3
	NAO as a calculator	Medium	Advanced	14
	NAO as a language teacher	Long	Advanced	11
	NAO learns to draw and write	Long	Extreme	16
NAOmarks	NAO recognizes traffic signs	Medium	Easy	2
	NAO plays rock-paper-scissors	Medium	Easy	6
	Remember that?	Medium	Advanced	9
	Playing dice with NAO	Long	Extreme	18
NAO remote control	Steering NAO	Medium	Easy	8
	NAO helps tidy up	Long	Advanced	10
	Template: NAO remote control	Long	Extreme	20
Sport with NAO	NAO recognizes a red ball	Medium	Easy	5
	Playing ball with NAO	Medium	Easy	4
	Gymnastics with NAO	Long	Easy	7
	NAO plays soccer	Long	Extreme	15
Entertainment	NAO tells a joke	Medium	Advanced	13
	Your own Basic Channel!	Long	Extreme	19

Tips and tricks

1. Do not work with your NAO on tables or other raised surfaces.
2. Disconnect the Ethernet and charging cables from NAO after you have transferred the program (risk of tripping).
3. Charge NAO while it is not in use.
4. Do not set the speed of the NAO movements above 80% as it could overbalance (recommended values: 60% - 70%).
5. Always let your NAO move on an even and stable surface, otherwise it is more likely to fall over.
6. Do not lift up NAO while it is sitting as this triggers the Fall Detection. (The Fall Detection is a procedure that is always active on NAO. If NAO falls, it prevents serious damage. NAO goes into a protective position very quickly. Your fingers could become trapped when this happens.)
7. Only move NAO by holding it under the arms in a standing position.
8. Do not leave NAO unattended for a longer period of time.
9. Use the Pose Library with caution. If you want NAO to stand up, use the Stand Up box. (The Pose Library is a collection of several positions that NAO can assume.
10. Only store NAO in the styrofoam box or the transport case that is available separately, or lean it against a wall with a piece of fabric in between (risk of tipping, damage).
11. When NAO is switched off, the battery needs around 2 hours to charge from 0% to 100%, when switched on around 2.5 hours.
12. It needs around 2-3 minutes to start up.
13. Keep the styrofoam protection provided as storage for NAO.
14. If you work with Choregraphe 2.8.X, only use NAO⁶. If you work with NAO⁶, only use the latest version, Choregraphe 2.8.X.



Tips for troubleshooting

If a program is not running as planned, ask yourself the following questions:

General

- ☐ Are you connected to a "real" NAO?
- ☐ Do you have the latest version of your project open?
- ☐ Did you try reconnecting to NAO?
- ☐ Did you try reconnecting to the network?
- ☐ Did you try restarting Choregraphe?
- ☐ Did you restart NAO?
- ☐ Did you try restarting the network?
- ☐ Have you replaced umlauts, accents, or special characters in the path for Choregraphe projects or in file names?
- ☐ If NAO doesn't want to stay in position, have you deactivated Autonomous Life?

Programming with Choregraphe

- ☐ Have you been through the program step by step?
Tip: It often helps to explain to a person or object (like a rubber duck or soft toy) how the program works and which individual steps are taken. This helps to uncover errors.
- ☐ Are the boxes connected correctly?
- ☐ Is there a connection missing somewhere?
- ☐ Are the parameters of the box correct?
- ☐ If a certain box doesn't work, have you tried deleting the box and recreating it?
- ☐ Are the key parameters in the Memory boxes (Insert Data, Get Data) correct?
- ☐ Are the key parameters in the Event boxes (Subscribe to Event, Raise Event) correct?
- ☐ Was the right camera selected (top/bottom)?

Timelines

- ☐ Have the frame names been written correctly in the Goto boxes? Are there any typos in the frames?
- ☐ Were the keyframes set correctly?
- ☐ Are the keyframes in the right places?
- ☐ Are the Stop/Play boxes in the right place?

Vision Recognition

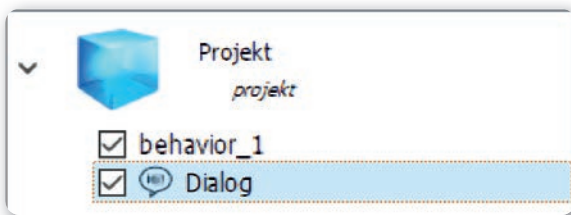
- ☐ Did you send the Vision Recognition Database to NAO?
- ☐ Is the room light enough?
- ☐ Have you tried teaching and saving the object again?
- ☐ Is the alignment of the object correct?

Python

- ☐ Is there a `self.onStopped()` at the end in the Python source code that ends the box and issues a signal at the `onStopped` output?
- ☐ Is there a `"self."` missing in the Python source code?
- ☐ Is your source code indented correctly?
- ☐ Have you written the variable and method names correctly?

Dialog

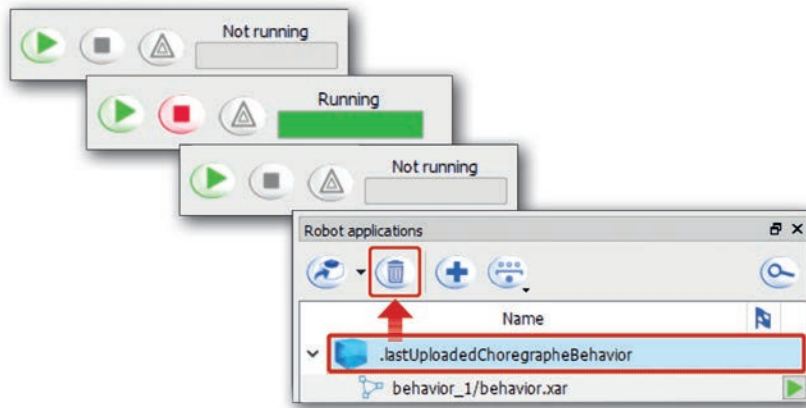
- ☐ Are there parentheses, colons, tildes (~) missing anywhere?



Screen 1.3.1 - Dialog under "Project Properties"

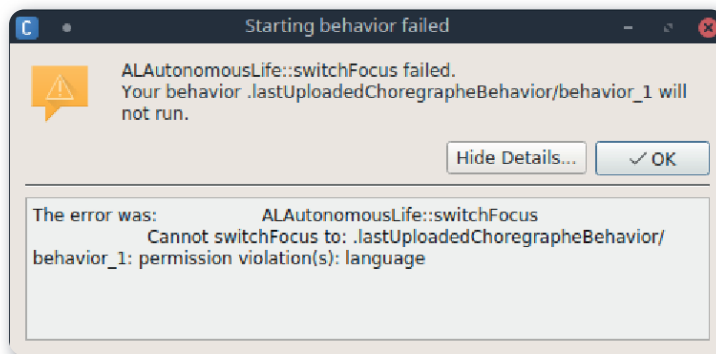
- ☐ Was the dialog selected in the "Project Properties"?
- ☐ If you are unable to insert a dialog in your language, was this language selected in the supported languages in the project properties?

Special cases



Screen 1.3.2 - Upload error

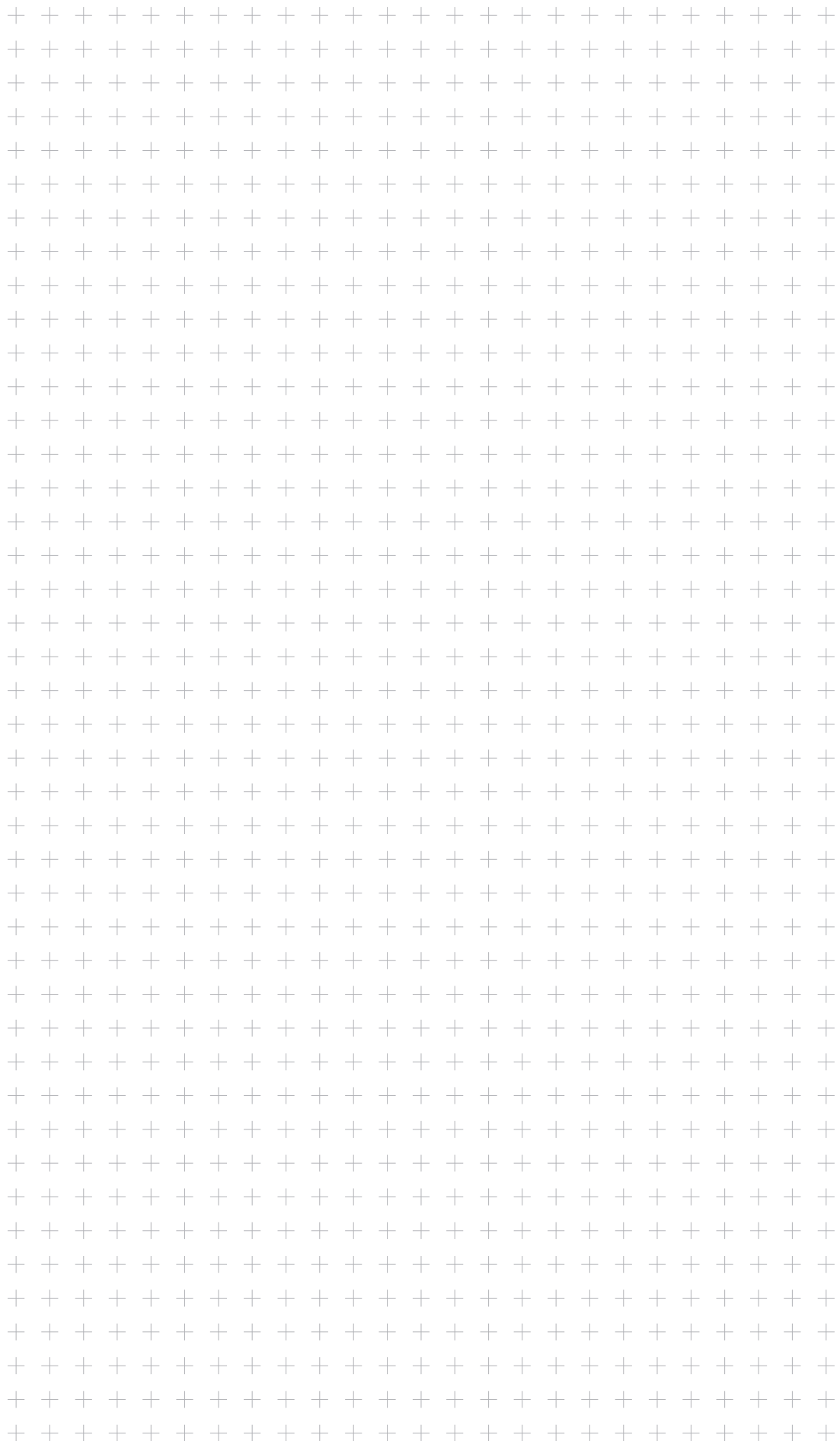
- If you click on the green start arrow and the bar to the right briefly turns green and then switches back to "Not running", you can try to delete ".lastUploaded-ChoregrapheBehavior" under "Robot applications" and upload your program again.



Screen 1.3.3 - Error "Starting behavior failed"

- If this error appears, you need to select the language currently used by NAO under Properties > Supported languages. American English should mostly suffice. If the error still appears, you can select all installed languages for NAO.

NOTES



Structure of the projects

The structure of the projects is described below. This structure is used for every project idea.

Overview

The overview gives you a brief insight into the project. After a short introduction to the topic and a picture, there is a brief description of the project or game.

Objects required and preparation

This section lists the objects required for the project. If you need to prepare something, the steps are explained. If there are digital materials for a project, they can be found in the virtual archive.

Suggested solution

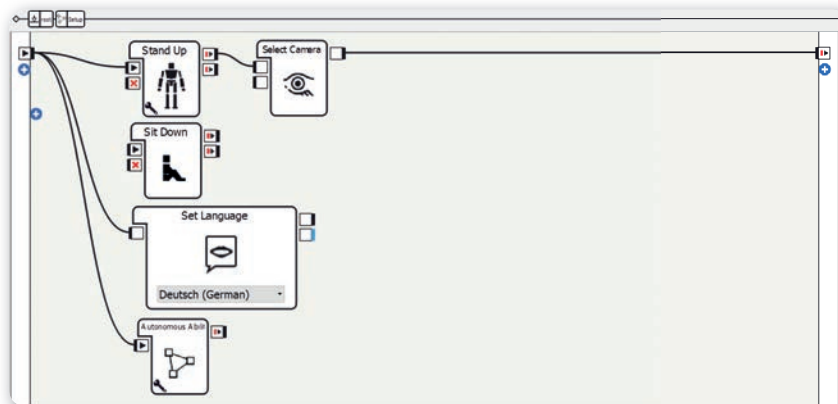
Under the "Suggested solution" heading is a step-by-step explanation of how to program the project.

Most projects have a Setup diagram and a Start Condition diagram. The structure of these diagrams in the individual projects is very similar. In the projects, you only need to make small changes.

The basic framework

In the basic framework you can see the rough flow of the program. Mostly, Diagram boxes are used to keep the project clear and easy to follow.

The Setup diagram



Screen 1.4.1 - The Setup diagram

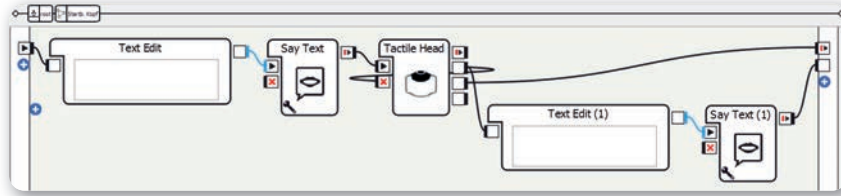
Here are the boxes that need to be run when the program is started. The structure of the Setup diagram is the same in most projects, however changes are sometimes needed. These changes are explained in the individual projects.

You can create a general Setup diagram as follows:

1. Create a Stand Up or Sit Down box
2. Create a Select Camera box
3. Create a Set Language box
4. Set the language in the Set Language box to your language
5. Create an Autonomous Abilities box
6. Make connections as shown in the screenshot

The Stand Up or Sit Down box makes NAO stand or sit. The Select Camera box activates the top or bottom camera, depending on the input connected. The Set Language box sets the language to the one you chose so that you can play with NAO in your own language. The Autonomous Abilities box activates or deactivates NAO's automated processes (e.g. blinking or idle movements).

Start Condition diagram



Screen 1.4.2 - The Start Condition diagram

The Start Condition diagram starts or stops the project. The sample texts you can write in the Text Edit boxes are described in the individual project ideas.

You can create a general Start Condition diagram as follows:

1. Create a Text Edit box
2. Create a Say Text box
3. Create a Tactile Head box
4. Connect the frontTouched output with the onStop input of the Tactile Head box
5. Create another Text Edit box
6. Create another Say Text box
7. Make connections as shown in the screenshot

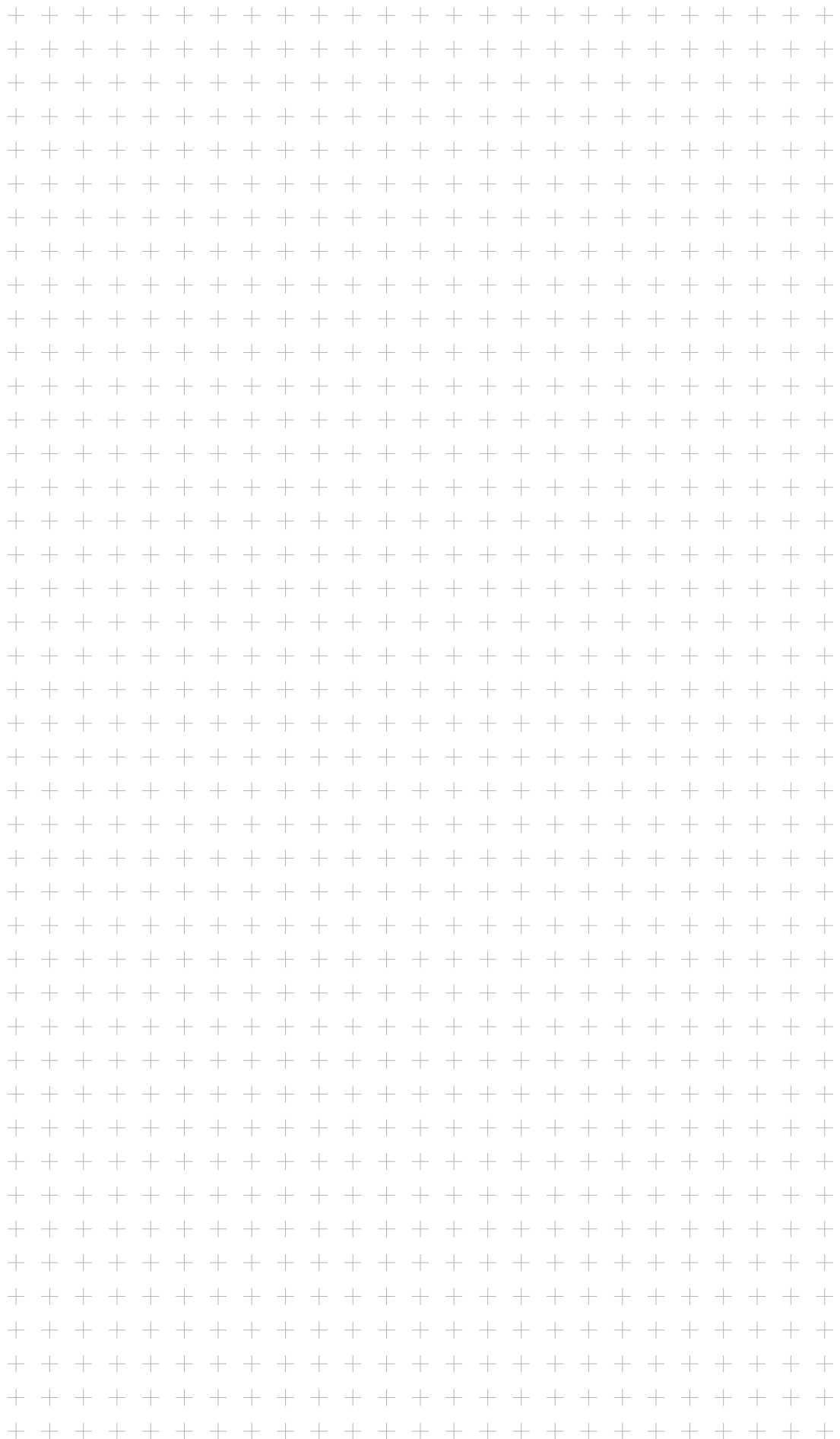
In this general Start Condition diagram, the program is started by touching the front head sensor and stopped by touching the rear head sensor. If you want, you can use other pressure sensors, speech recognition, a Naomark, or a smile (using the Get Smile box). It's up to you what you choose.

More project ideas

Depending on the project, there are more project ideas to give you inspiration. If you don't see this heading, then none are listed for this particular project.



NOTES





1

NAO as a sales assistant

Overview

Can robots replace human sales assistants in retail? Robots can access databases and the Internet while people have the advantage of charisma and feelings.

The "NAO as a sales assistant" project is a simple question-and-answer game between NAO and a customer. After a few questions, the customer has found the product they are looking for.

Objects required and preparation



Image 2.1.2.1 - Objects required

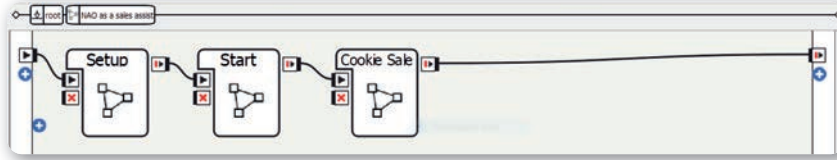
For this project you need:

- Optional: Cookie packages or containers
- Optional: A sales stand

You don't need any objects but to make it more realistic, you can use suitable props such as cookie packages and a sales stand.

Suggested solution

Basic framework



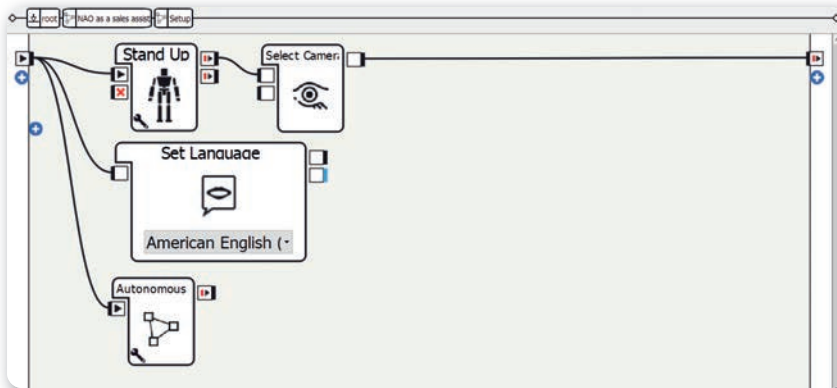
Screen 2.1.3.1 - Basic framework

Method:

1. Create three Diagram boxes
2. Rename the Diagram boxes as Setup, Start, and Cookie Sale
3. Make connections as shown in the screenshot

Sequence of the program: After the Setup diagram, NAO reacts to the signal word "NAO". Then NAO introduces itself and asks whether you would like chocolate or not. If you answer "no", it offers you cookies without chocolate. If you answer "yes", it asks whether you would like dark, white, or milk chocolate. It offers the recommended type of cookie depending on the answer.

The Setup diagram

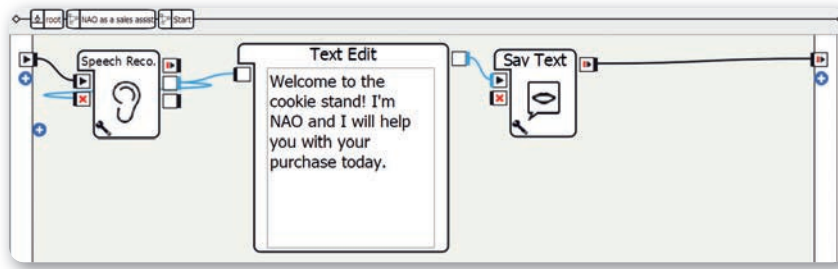


Screen 2.1.3.2 - The Setup diagram

The structure of the Setup diagram is explained in "Structure of the projects". In this project you need to be aware of the following points:

1. Use the Stand Up box
2. **Only activate the** Autonomous Blinking and Background Movement parameters in the Autonomous Abilities box; deactivate the other three.

The Start diagram



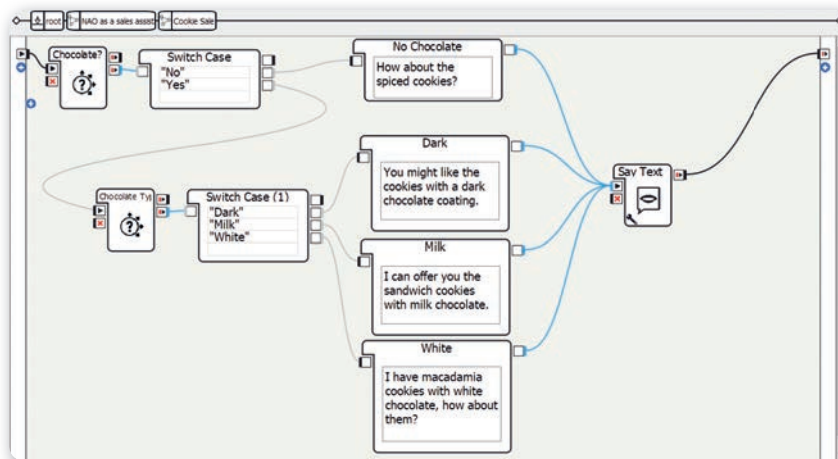
Screen 2.1.3.3 - The Start diagram

Method:

1. Create a Speech Recognition box
2. Set the Word List parameter to "NAO"
3. Create a Text Edit box
4. Set the text to something like "Welcome to the cookie stand! I'm NAO and I will help you with your purchase today."
5. Create a Say Text box
6. Make connections as shown in the screenshot

In this section, NAO welcomes the customer. The Say Text box then says the text entered.

The Cookie Sale diagram



Screen 2.1.3.4 - The Cookie Sale diagram

Method:

1. Create a Choice box and do the following:
 - a. Under Localized Text, select the language you want and enter the question, here: "Do you like chocolate?"
 - b. Under Choice, select the language you want and enter possible answers, here: "Yes" and "No"
2. Create a Switch Case box and enter the cases "Yes" and "No"
3. Connect the Switch Case box to the Choice box for chocolate yes/no
4. Create a Text Edit box and connect it to the "No" case of the Switch Case box
5. Set the text to something like "How about the spiced cookies?"
6. Create a Say Text box
7. Create another Choice box, connect it to the "Yes" case of the Switch Case box, and do the following:
 - a. Under Localized Text, select the language you want and enter the question, here: "Which type of chocolate do you prefer? Dark, milk, or white?"
 - b. Under Choice, select the language you want and enter the possible answers, here: "Dark", "Milk", and "White"
8. Create a Switch Case box and enter the cases "Dark", "Milk", and "White"
9. Connect the Switch Case box to the Choice box for the type of chocolate
10. Create three Text Edit boxes and connect them to the three cases of the Switch Case box for the type of chocolate
11. Set the texts to something like:
 - a. Dark: "You might like the cookies with a dark chocolate coating."
 - b. Milk: "I can offer you the sandwich cookies with milk chocolate."
 - c. White: "I have macadamia cookies with white chocolate, how about them?"
12. Create a Say Text box
13. Make the rest of the connections as shown in the screenshot

This is where most of the interaction takes place: NAO asks whether you want chocolate or not. If you don't want chocolate, it offers spiced cookies. If you do, NAO asks what kind of chocolate you would like. It offers different types of cookie depending on the answer.

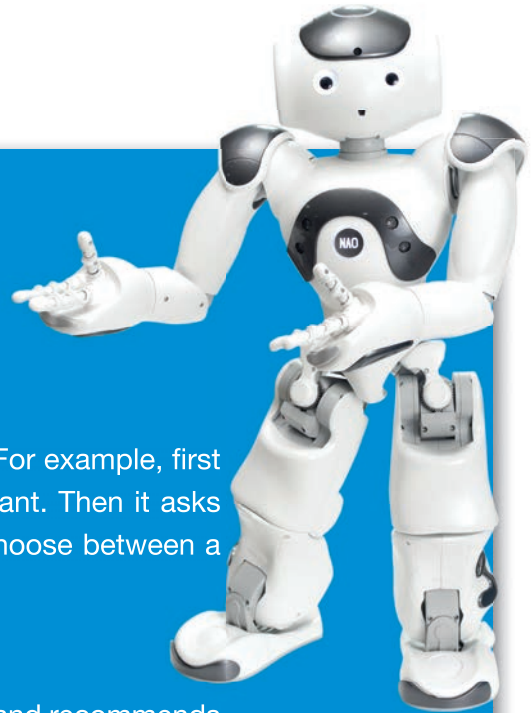
More project ideas

NAO the ice cream seller

You can program NAO as an ice cream seller. For example, first it asks how many scoops of ice cream you want. Then it asks what flavors you would like. Lastly, you can choose between a cone and a cup.

NAO the shoe seller

NAO presents you with different types of shoe and recommends different models. For example, first it can ask what shoe size you have. Then it asks whether you want the shoes for everyday, sport, or a special occasion. Finally, it asks for your favorite color. The customer is given a selection of shoes based on these criteria.



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<https://www.softbankrobotics.com/emea/fr/nao-robot-education-ebook>

On a Sharefile folder you will find :

- The Basics - Learn it NAO6 ebook (pdf file)
- The Creative Projects Ideas - Do it NAO6 ebook (pdf file)
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