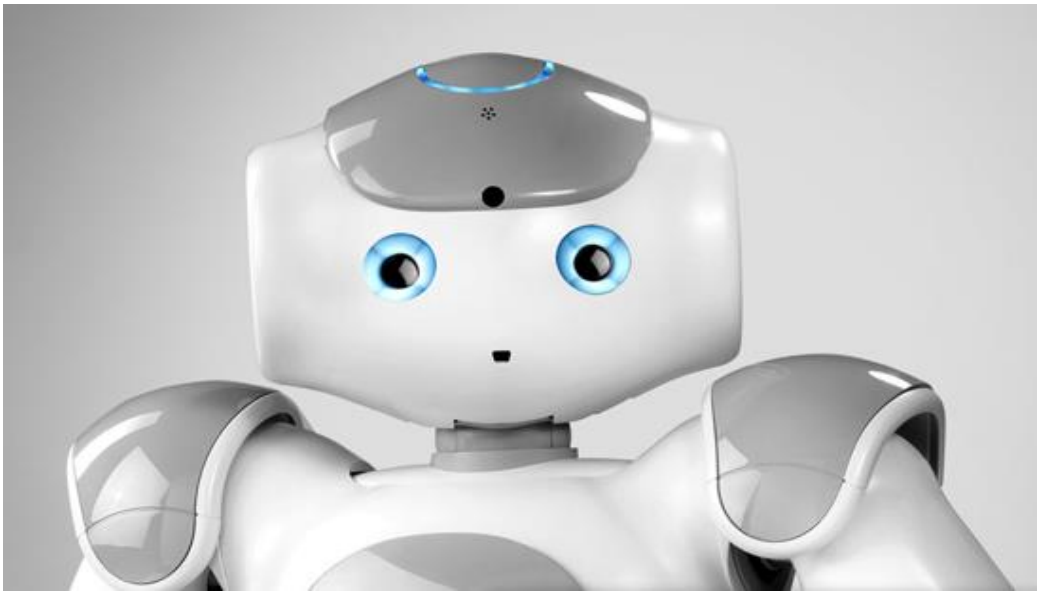

Project NAO

Version: 0.1

Project name	Project NAO	
Responsible	Executive	
Created on	20/10/2015	
Last changed	22/12/2015	
Processing status	X	in process
		submitted
		completed
Document file		

Further Product Information

Participating	Melanie Mühleder, Viktoria Streibl, Sabina Brantner
Creation	App development, NAO soccer

Change Listing

Change			Changed Chapters	Description of changes	Author	State
No	Date	Version				
1		0.1	all	Initial product creation		

Content

1 INTRODUCTION

This project is about working with NAOs, small humanoid robots, and is split in two blocks.

The first one is about an App to help the costumes to make handling with NAOs easier. The app will be available at the Play Store and includes already finished actions.

The second block is the RoboCup, a worldwide robot competition. There are teams of NAOs which have to play against other teams of robots at soccer. To be able to take part, there is a need of a perfect program, which includes artificial intelligence.

At the following pages, there are some further details about the situation, why this project is important and what the benefits are. There is also information about the programming and technical framework condition. Furthermore the proposal informs about the system concepts, NAOs itself and the NAO soccer. Finally yet importantly, there is the general Planning and the Risks and Opportunities.

2 INITIAL SITUATION

NAO is an autonomous, programmable humanoid robot developed by Aldebaran Robotics, a French robotics company headquartered in Paris. NAO robots have been used for research and education purposes in numerous academic institutions worldwide. The programming languages for these robots are C++, Python, Java, MATLAB, Urbi, C and .NET.

Through our school, which owns three NAOs, we got in touch with the robot-development. Last school year we started to play around with the NAOs. We made one choreography, which we are going to present at the Welser Messe. To make the three robots distinguishable we give the robots names.The grey ones are called Luc and Judy and the red one is called Sue.

2.1 Representation and Education Purpose

For representation purposes it turned out to be useful to have a large variety of different choreographies available. It should be possible to change these choreographies quickly. Therefore it would be useful to have the choreographies centrally stored on a server and the user should be able to download these from the server to the NAO via a mobile app.

Furthermore it would be helpful to have standard actions like stand-up, move forward, etc. easily available. These could also be downloaded from the server or ones PC. It could be used at events or meetings to show what the robots can do. Another situation where it can be used, is at school, so children can learn with them and the teacher haven’t to know how to program a NAO.

Moreover, our institute is well known for the success at the “Miro Sot”, a soccer championship for wheeled robots, which are smaller than 7.5 cm x 7.5 cm x 7.5 cm.

Today we plan to re-establish the participation of the HTL Leonding in such leagues. The current main league is the RoboCup Standard Platform League.

The RoboCup Standard Platform League is an international competition with autonomous robotic soccer matches as the main event.

In the Standard Platform League, all teams use identical robots. The robots operate fully autonomously, for example there is no remote control by either humans or computers during the games.

To participate in the SPL the following issues have to be solved:

- For the NAO Standard Platform League one needs five grey NAOs, i.e., Sue has to be replaced by a new grey robot and two more robots have to be acquired
- Due to hardware issues Judy can’t stand up autonomously and it loses screws
- Luc has problems with the movement of its right arm

3 GENERAL CONDITIONS AND CONSTRAINTS

3.1 Application for the NAOs

The user interface will be developed for android devices and it runs on Android API 23. The application is multi-language capable (English and German). It will be developed in Android Studio and the programming language is Java.

3.2 RoboCup

For the RoboCup we need for native programming C++. As explained above we need 5 grey robots and we've only got 2. The IDE in which we program is NetBeans. We have invested a view hours to acquire C++ skills.

The following rules of the SPL have to be obeyed. A detailed list can be found under https://www.informatik.uni-bremen.de/spl/pub/Website/Downloads/Rules2015.pdf

4 PROJECT OBJECTIVES AND SYSTEM CONCEPTS

4.1 App

The Representation and App should enable the user to easily change choreographies or basic actions. It means that it is not necessary to have programming skills, but also advanced programmers can use it and add their own Actions.

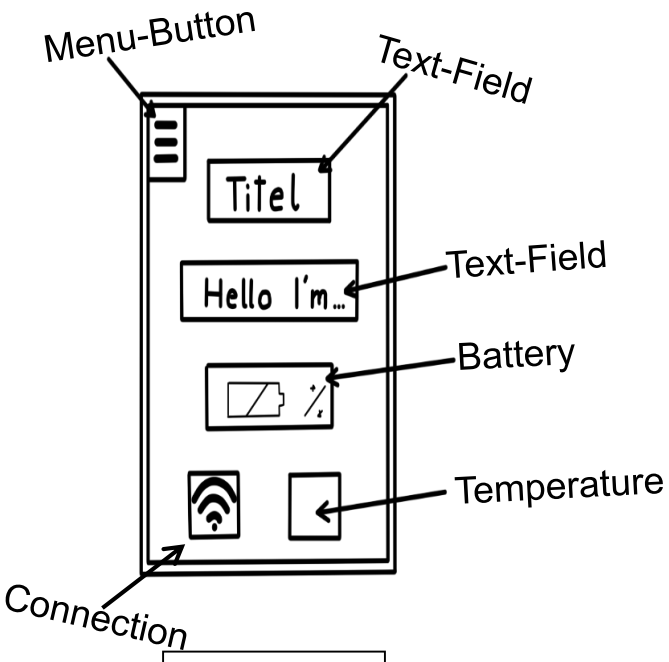

Image 4.1

In the home screen (see image 4.1) below the title the name of the NAO connected and its battery status is displayed. The two buttons at the bottom are for the connection (see image 4.3) and for displaying the temperature, respectively.

Besides a title field, on every screen there is a menu button at the left top corner which is shown in image 4.2. If the user clicks on the menu button, the background gets darker and a Pop-Up appears. There it is possible to choose one of the points, to switch to the next layer.

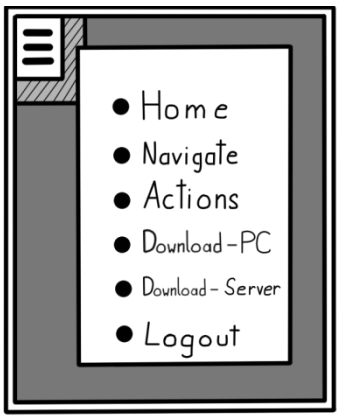

Image 4.2

If the user clicks on the user clicks on the connection button, there also appears a Pop-Up. The biggest part of it is the picture of the NAO, to which the app is connected. Below this, the IP-Address of the connected NAO is shown.

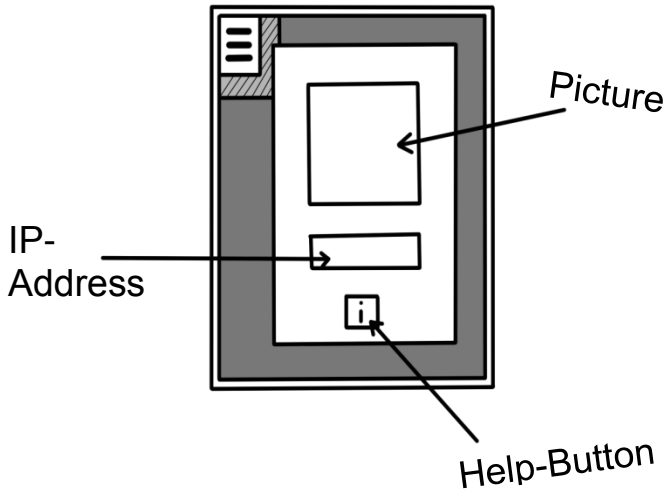

Image 4.3

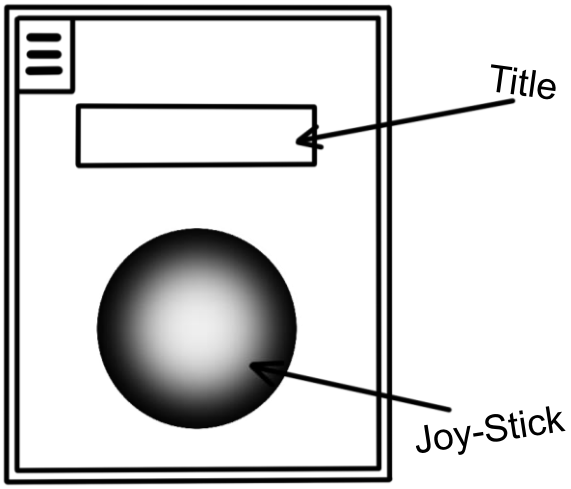

Image 4.4

The next menu point is Navigation. Under the title there is a big circle, representing the navigation joy-stick by which, the NAO movements can be controled. If the navigation- circle gets pushed ahead, it's the command to walk forward. Depending on direction and strength of the user's gesture the NAO movements change.

The next menu point links to the Action screen.

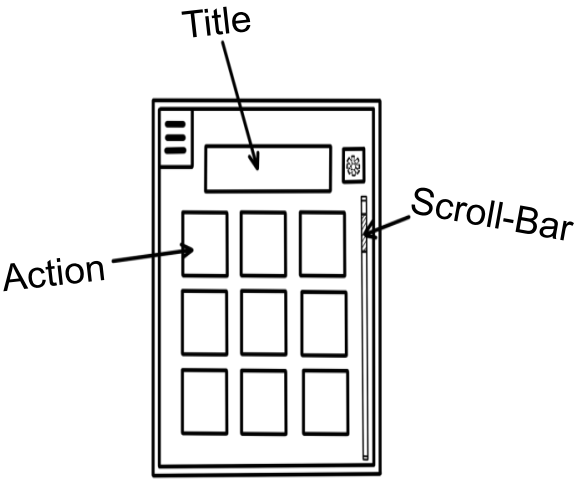

Image 4.5

Actions are small code snippets to control the NAO. With only one touch the NAO do the Dance, sit down or what ever the user told it. Actions are either prefabricated or can be self-developed. These actions are either stored directly on the phone, or come from the server.

The final two menu items are related to connecting the App to the PC or to the server to enable the download of Actions from these devices.

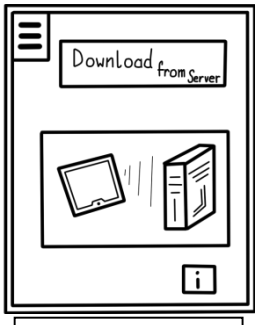

Image 4.6

Image 4.7

4.2 NAO Soccer

The second part of this project is about NAO Soccer.To take part in the Cup, the NAO needs a programm which runs without human help. The robot can only “see” with it´s cameras, i.e., we have to programm the robots, that they can recognice the ball, the soccer field, the goals, own and opponent players, etc.

Based on these visual perceptions and strategy input the NAOs have to plan their movement and actions autonomously. Only the whistle of the referee starts or stops the running program.

5 OPPORTUNITIES AND RISKS

The project has the following opportunities:

- With the android app you are able to save time because of the existing functions like controlling the robot, or presenting those in meetings.
- Easier handling for people with little or no programming know-how.
- Easy service and developmental potential for the app.
- Promotion for our school in Robo-competitions.

The following risks have to be taken into account:

- Not much costumers in cause of the expensive robots.
- Little capital to buy robots.

6 PLANNING

Robo Soccer	
Date	**Task**
undefined *	**Robot can recognize a soccer ball on the field.**
undefined *	**Robot can react with motions in association with the ball.**
undefined *	**Robot is able to take a kick motion.**
undefined *	**Robot is able to orient his feet in direction to the ball.**

App	
Date	**Task**
12. Feb 2016	**Prototype of the app.**
29. March 2016	**User can connect to a specific NAO through the web.**
24. May 2016	**User is able to control the NAO with the joy-stick.**
21. June 2016	**User can conntect to the server and download the prefabricated functions via app.**
28. June 2016	**User can handle the NAO´s motions with this connection.**

* Considering on Aldebaran (repair NAOs)