Assignment Cover Sheet

Faculty of Science, Engineering and Built Environment

NAME: SATVIK SHARMA

STUDENT ID: 218595095

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Report on NAO's Multitasking Applications

Problem statement

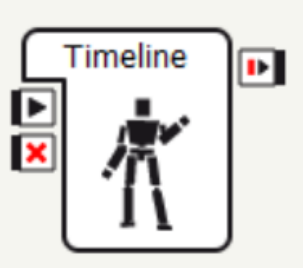
Multitasking or doing multiple things at once is the basic feature every living being possess. In the light of this, robots are designed so that the perform different tasks at one particular time and maybe even perform better. This will lead the field of robotics to a different level. The main task here is to make the NAO robot perform a number of tasks at once.

Firstly, it will be investigated how the robot can multitask at a one particular time with the help of 'Timeline'. After this the problem of dancing NAO with the help of animation will be discussed.

Background knowledge

Every robot is having its own degrees of freedom, that is, the axis about which the robot can move its body. Nao robot is having 25 degrees of freedom and it is better observed in the link https://www.youtube.com/watch?v=3vODXko4vaU.

The next thing to know is the timeline panel. It is the easiest way to control the joint in the robot and record a series of joint keyframes. The frame per second can be changed from 25 to whatever it is required. the animation of the robot can also be changed using the graph editor.



In the timeline, one must know about the animation mode and storing multiple data in the keyframes. Further documentation is provided in the link http://doc.aldebaran.com/2-1/software/choregraphe/tutos/movements.html#choregraphe-tuto-animation-mode.

Most importantly, the robot should not lose its balance otherwise it might break. For support and balance, the robot uses the concept of centre of mass. If the robot's centre of mass is changed while performing the tasks, its centre of mass is changed and the angular momentum for the head will increase and can destroy the robot's brain.

Investigations

A number of investigations were conducted to make the NAO robot multi- task in a particular time and dancing the robot using the animation tool. In the first task, the use of timeline will be discussed by making the robot wave it' hand. The second will be talk about the animation mode by making the robot dance on the macarena dance.

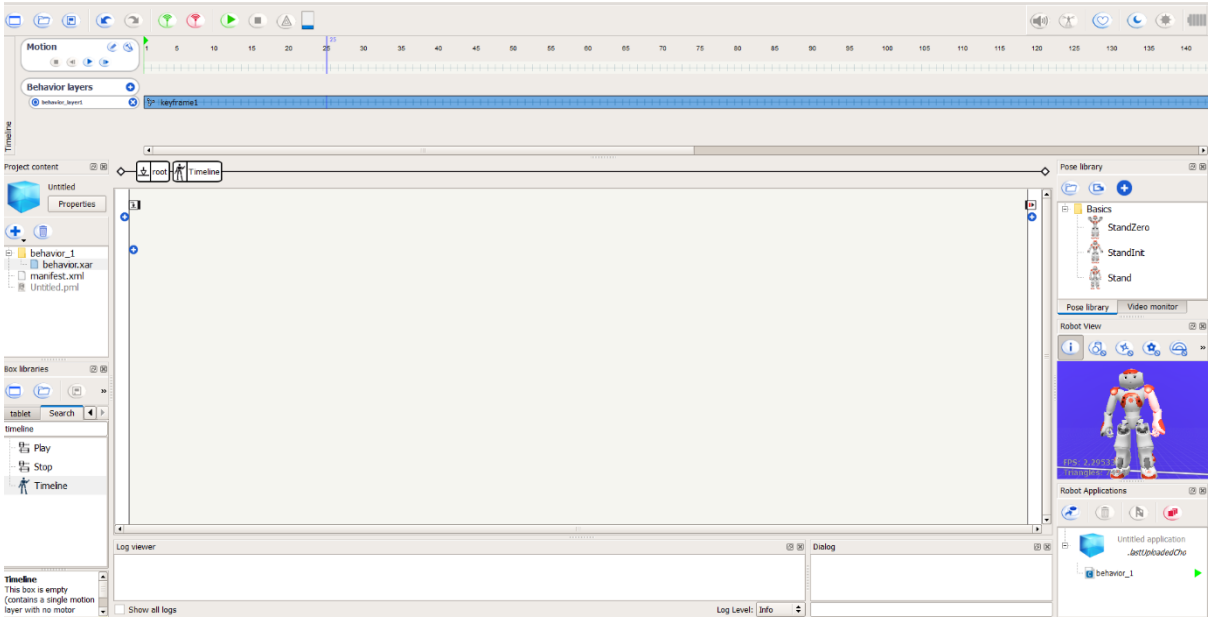
1.Using timeline

Objective:

The objective here is to understand the concept of timeline by making the robot say hello and wave its hand simultaneously.

Solution Design:

First of all, the timeline box was added. By double clicking the timeline box, the window show something like below.



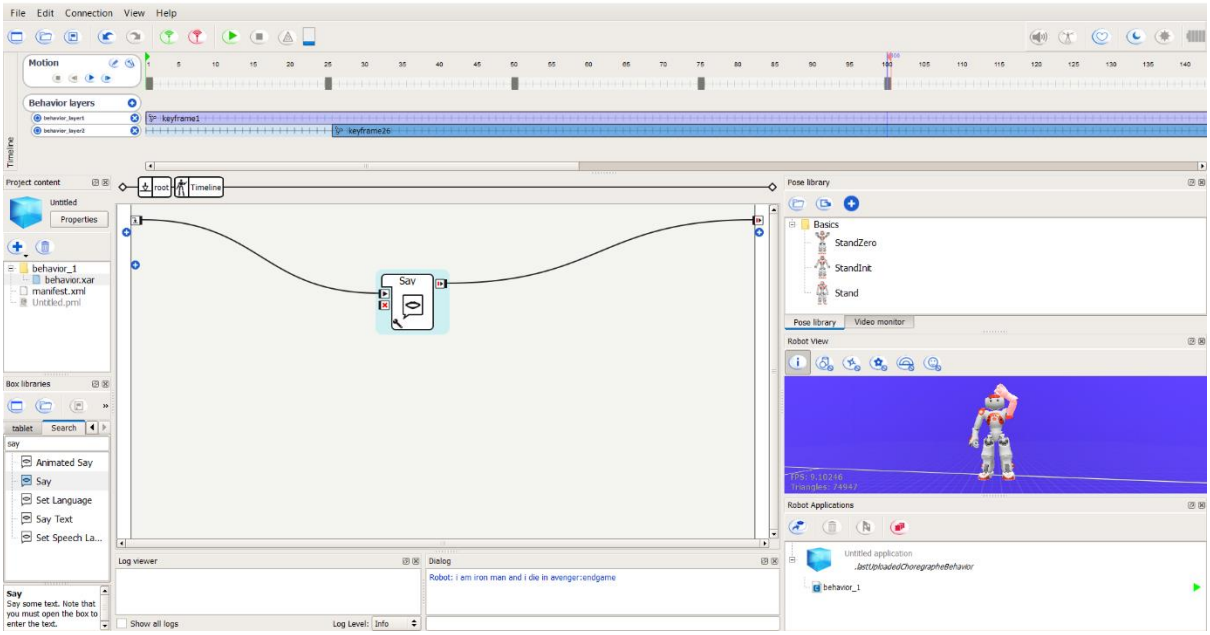
Now create a waving motion in the robot, with the keyframes, body parts and angle as written below in the table.

Frame	Joint	angle
25	Whole body	(press F8)
50	LShoulderPitch	-40
65	LElbowYaw	-15
85	LElbowRoll	-70
	LwristYaw	25
100	LShoulderRoll	30
	LElbowRoll	-25
110	LElbowRoll	-10
125	LShoulderRoll	10

	LElbowRoll	-35
135	LShoulderRoll	15
	LElbowRoll	-45
150	LShoulderRoll	30
	LElbowRoll	-25
160	LElbowRoll	-10
175	LShoulderRoll	10
	LElbowRoll	-35
185	LShoulderRoll	15
	LElbowRoll	-45
200	LShoulderPitch	-40
225	Whole body	(press F8)

The next step is to create another behaviour layer, by just pressing the '+' sign.

In the second behaviour layer, add a say box and in that say box, write so that the robot say something for example hello world.

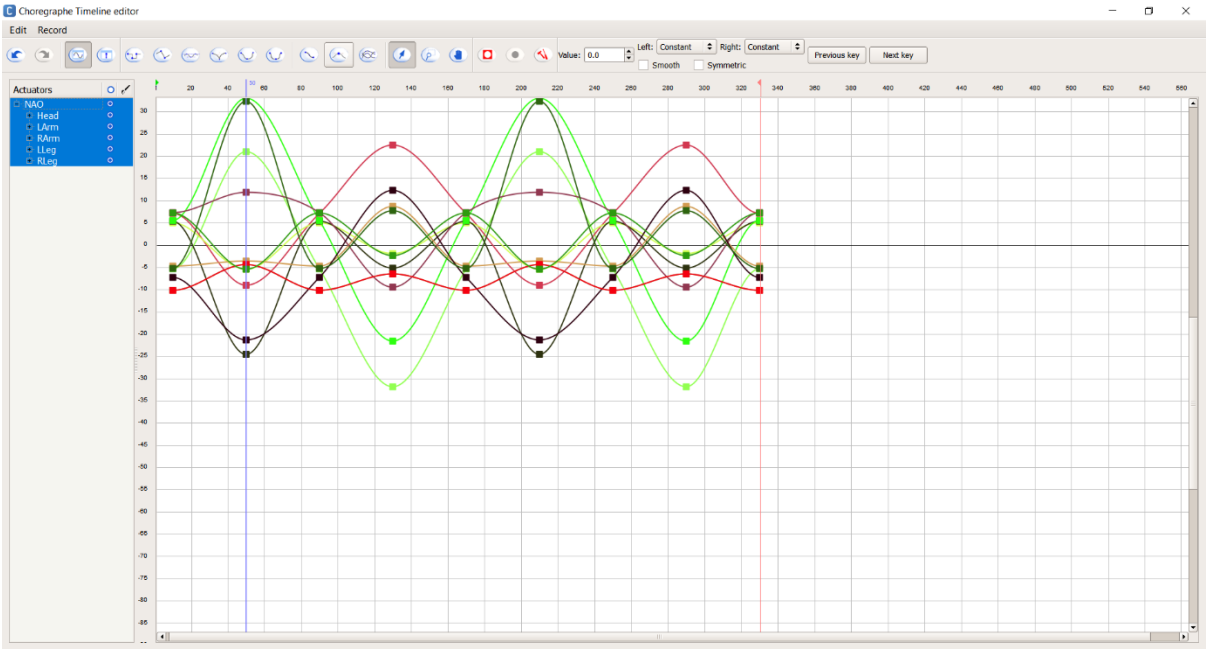


Risk assessment and precautions:

Since in this task the robot's joints are used, it will be better if the animation is initially used on the virtual robot and makes sure that the robot does not fall over. Moreover, using the robot heats up the joints and motors. When the robot is not in use the robot must be placed in sleep mode so that the overheating does not occur. Another precaution that should be taken while using the robot is to make sure that the joints in the arms and legs do not pinch.

Testing procedure:

We used different methods to test the solution. We changed the keyframes of the the timeline. Changes were also made with the help of graph editor.



Outcomes:

NAO performed the task as it was expected. It spoke when its keyframe started. This means that the robot can do multitasking with the help of timeline. Even though, there was some difficulty in setting the angles of the left arm of the robot, but it if done properly on the virtual robot, one cannot face much difficulty.

Reflection

This reflects that NAO can show multitasking abilities and can be used in many commercial and domestic places, for example, used in construction sites. The controlling of the robot was somewhat puppet-like, which means that it can be controlled by someone and instead of using strings, choregraphe is used.

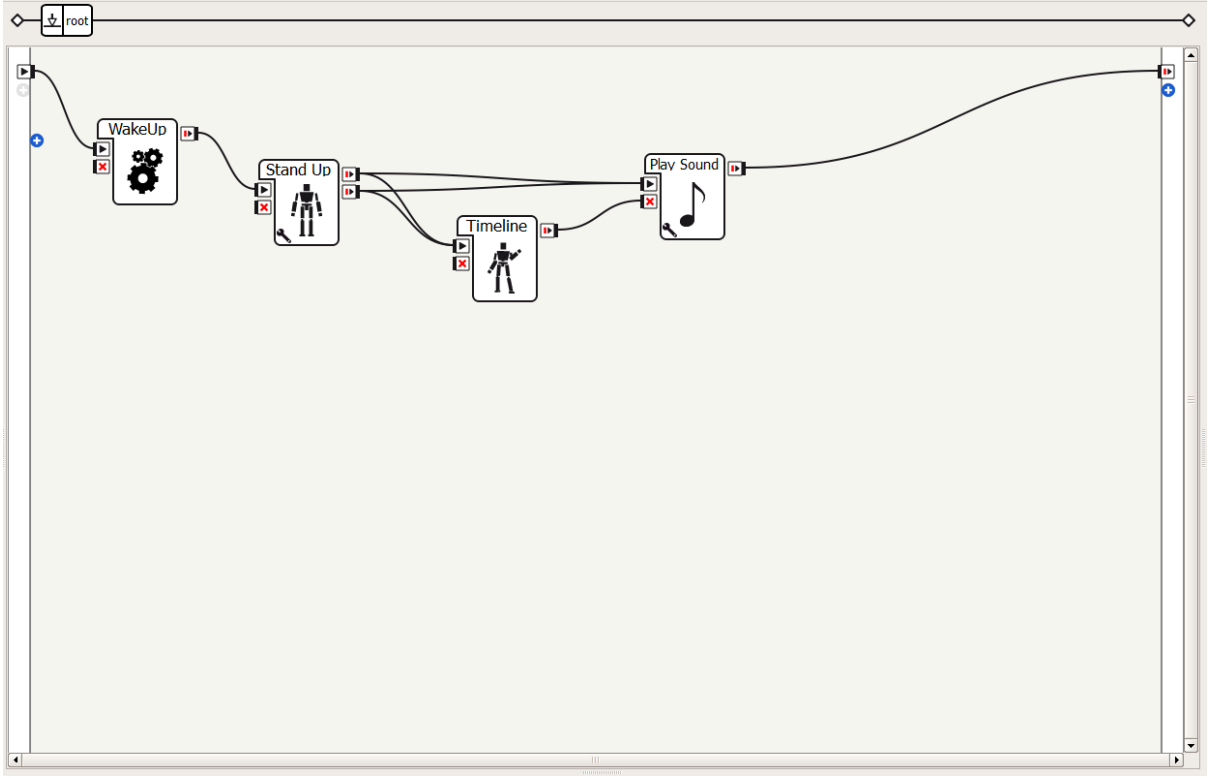
2.Animation

Objective:

The agenda in this task is to animate the robot. In this task robot is animated using the macarena dance and the song is played alongside it.

Solution design:

This task was done using the already provided macarena timeline and the song provided along with it.



This timeline consists of the dance movements only and the additional play sound box was added. In that play sound box, the macarena song's file is imported.

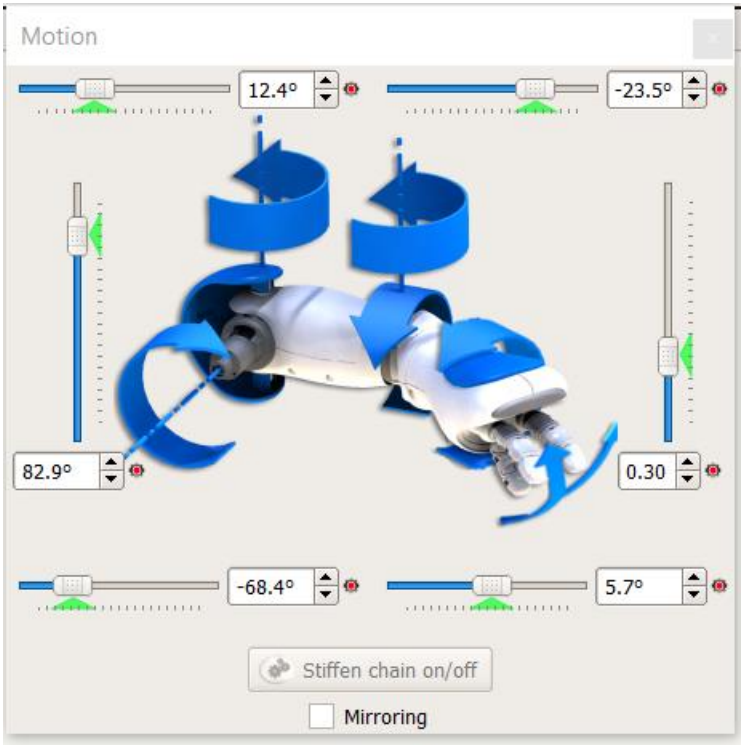
Risk assessment and precautions:

Since the problem here is dealt with the stability in the robot, care should be taken while performing the task. Moreover, before going on to the real robot, the task should be performed on the virtual robot so that it minimises the possibility of robot falling down.

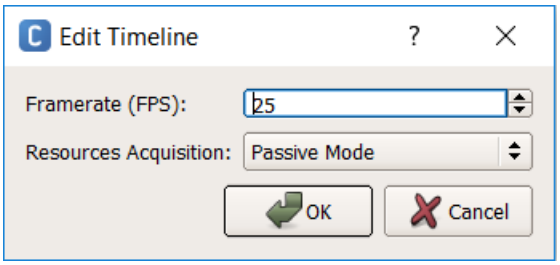
Testing procedure:

To test the solution design, I first changed the keyframes and made them tighter. This made the robot to perform the task much faster on a slower beat. Next thing I did was to make the keyframes much farther apart, which made the robot perform a slow dance on a fast beat.

Some of the actions were also changed to make the movement much smoother. Even though this test went in vain as once robot stuck its arm behind his head and had to be done again, but if more movements are provided the robot can perform different types of animations altogether.



The changing of frame rate also changes the smoothness, for example, the video quality of the 60-fps video will be much better than the 25-fps video. In the same way the animation in robot will be much smoother at a higher fps rate than a lower one.



Outcomes:

The testing procedure worked as was expected. Even though the robot showed some signs of unstability, but it was really minor which could be ignored. Moreover, while testing, when the keyframes are set closer, the unstability in the animation increases, which further increases the chance of robot falling down.

Reflection:

This animation module reflected that NAO can come in handy while it is multi-tasking. It has a lot of scope in the future and requires a research based on the multi-tasking in robotics and its applications. However, while doing this task and watching NAO, it arises a lot of new possibilities to discover in the animation in the field of robotics.

Conclusions

In this lab report, the multi-tasking in NAO was discussed. Firstly, the use of timeline to create more than one behaviour at one particular time was discussed, in which the robot waved its hands and said “hello”. After this a complex animation program was made and in that program the robot had to dance on the macarena song. These modules create curiosities and lead to further possibilities in the field of robotics such as making the use of robot in commercial areas and performing those tasks in which human face difficulties.

References

- Deakin university, SIT122 resources
- More documentations from http://doc.aldebaran.com
- https://www.youtube.com/watch?v=3vODXko4vaU