Lecture 16: Experiment 05: Path and Gait Planning of 25 dof NAO Humanoid Robot (Contd)

So, we have seen how to conduct the different types of experiments on this particular, the 25 degrees of freedom NAO humanoid robot. Now, through this particular the experiment, we have come to a few inferences and a few findings which we got, we are going to discuss one after another. The first thing is your, through this study, the experimental study on this humanoid robot, we could get enough information regarding the construction details of this particular humanoid robot like what are the different types of joints we have used and the way we can control the different joints to get the movement of the end-effector sort of thing or the final with respect to the base ok. So, all such things the nature of the joints ok. So, those things we could understand and we could also see to perform a particular task, how to divide that particular task into a large number of subtasks and to execute each of the subtasks.

So, how to make a program with the help of some already available library functions and how to connect them in a particular sequence, so that we can perform one assigned task and how to control that particular robot using the software through that your virtual robot, how to control the physical robot. And we could show you its ability to walk in the forward direction, the backward direction and its turning movement and all such movements are required by this particular robot to perform the different types of your the task ok. Then, we have seen that while performing the various tasks, the robot is able to maintain its dynamic balance which is very much essential for a humanoid robot ,walking of a humanoid robot or navigation of a humanoid robot. For example, whenever it is moving in the forward direction, it consists of the single support phase, double support phase, transition phase and the whole robotic system should be able to maintain its dynamic balance.

Similarly, whenever it is taking the turn, one thing is for taking the turn some body movements are to be extra body movements are to be generated and once it has taken the turn and while taking the turn, the balance has to be maintained. So, maintaining the dynamic balance is a must while taking the turn by a particular the humanoid robot. So, not only during its walking, but also during taking the turning movement, the robot should be able to ensure the dynamic balance of the body and whenever we conducted all such experiments, we could see that that this particular humanoid robot is able to generate that particular movement whether it is the forward walking, backward walking or turning by maintaining the dynamic balance. So, this robotic system is able to perform the preassigned task just like a one human-being, but of course, one human being has got more mobility levels compared to 25. So, if you just compare the performance of this particular humanoid robot, that is, the NAO humanoid robot having 25 degrees of freedom, it may not be at par with that of a human-being because we human-beings we have got even more mobility levels.

Now, while carrying out this particular experiment safely a few precautions are to be taken. So, I am just going to tell you all such precautions, which we should take before

conducting this particular the experiment. Now, in this particular experiment, we are going to conduct on the real 25 degrees of freedom NAO robot through one software using one virtual robot also. Now, before you are going to use the software on the real robot, this the quality of the software the status of the software has to be tested through computer simulation like whether it is working fine or not. So, without testing this software, we should not directly use on the real robot.

The next point is your we will have to make sure that the ground is not slippery. So, if it is a slippery ground, the robot is going to lose its balance. So, we will have to check whether the floor to be used during the experiment are slippery or not. We should not use the slippery floor. So, do not force any physical change on the robot.

That means, your by putting some extra external force, we should not bend any joint or we should not remove any parts. So, this external disturbance we should not put. Now, do not lift or move the robot suddenly. So, whatever you do, we will have to do it gradually like we cannot lift the robot with the help of our hand because it can handle only 5 and half kg weight. So, you can lift it very easily or we can move it very easily, but we should not do it quickly.

It may actually give some sort of unbalance in the system. Now, this power off and off has to be done by following the instruction given in the user manual. So, the user manual has to be read and its instructions are to be followed meticulously. Now, we will have to keep this particular robot away from water exposure and definitely there should not be like small children in the vicinity of that particular robot. So, out of curiosity, the children may also touch that particular robot and it will try to play and consequently it could be destroyed or damaged also.

So, the robot is actually equipped with a large number of sensors and cameras. So, cameras have got lens and sensors are to be cleaned properly at regular interval so that there should not be any accumulation of dust or dirt particles and we will have to monitor the temperature of the motor and battery that is a must. So, if there is any such undesired activities so, the temperature of the battery is going to increase. If there is any problem in the robotic joint, there will be jerky movement, there will be a lot of vibration and due to this friction the temperature is also going to increase. So, in that case you will have to stop the robot and just to prevent it from overheating and there must be preventive maintenance at a regular interval of this particular the robotic setup and the user should have a proper training of how to operate this particular robot, how to start and how to power up on an emergency basis and to put it in a short sentence one should know how to stop that particular robot, before starting that particular robot, because emergency may come and to avoid the further damage of the robot or any accident.

The user should know how to switch it off in an emergency basis and you can stop, you can power off that particular the robot. So, these are the precautions to be taken while

conducting experiment using this humanoid robot. Now, I am just going to discuss a little bit, what are the different applications or the fields where we can use the humanoid robot. Humanoid robot can assist in patient care just like a nurse it can supply medicine, it can help the patient to prepare their beds, to prepare their operations theatre and all such things, it can provide some rehabilitation. So, this particular the robot and it can help the elderly people also.

So, it has got some applications in healthcare and this humanoid robot can be used as interactive tutors also just to teach a few topics to the students, this humanoid robot can work as a tutor. And nowadays these humanoid robots are used in inspection, maintenance in the plants the real plants, where the human being cannot go. For example, if we consider the nuclear power plants and other places and there are some chemical plants and those chemical plants could be hazardous ok. There you can, you can send the humanoid robot to perform the task of your the human operator. We can use humanoid robot for carrying out some household activities like your cleaning the floor, cleaning utensils and all such things ok.

So, those things you can give it to the humanoid robot. Humanoid robot can work in dangerous hazardous environment, where we cannot put the human operator such as say bomb disposal, dangerous chemical handling, rescue operation, nuclear power plant we can use the humanoid robots. There are a few other applications also for this type of humanoid robots. Now here, I am just going to show you a few references. The participant can collect more information regarding this humanoid robot from these references. Thank you.