Lecture 07: Experiment 02: Control of Tracked Mobile Manipulator (Contd.)

Now, we have done the real experiment using this tracked mobile manipulator to carry out a few tasks related to agriculture. We have seen how to control this particular tracked mobile manipulator in the forward direction, backward direction and the way it can take the turn in clockwise or anticlockwise. We have seen how to do the disease detection with the help of camera-based image analysis and how to spray the appropriate pesticides to the plant leaves. Now, from this experiment, the following inferences could be drawn.

Now, while doing this particular experiment, we have understood how to control the vehicle, how to control the different joints of this particular the serial manipulator, which are required to perform some predefined task. Now, from this experiment, the following inferences could be drawn like this. We can increase the agricultural efficiency. So, how to increase this agricultural efficiency? So, we have integrated one tracked mobile manipulator with vision-based disease detection and pesticide spraying and by doing that, we could automate this particular task and we could reduce the need for the manual labour.

So, this is the way we could increase the efficiency that is the agricultural efficiency. We could also improve the productivity also and moreover, the human operator may not be liking to handle the health hazardous pesticide. So, this particular task we can give it to the robot and by doing that, we can save the human life because the farmer or the worker who are working in the field, they may not like spraying the health hazardous pesticides. So, this particular task we are going to give it to the robot. The name next is the timely disease detection.

Now, this developed vision-based system will help us to do the early and accurate disease detection. So, by doing this timely intervention and treatment, actually we can monitor the health of the crop and we can improve or increase the productivity or the yield. So, this is one merit which we are getting by using this particular robot in agricultural the field. The next is your precise and targeted pesticide application. So, this particular system, the developed system will be able to help us to decide the appropriate pesticide.

That means, that particular chance of doing mistake is much less, so that the wrongly selected pesticide we should not spray to the plant leaves. So, proper selection will be done with the help of this image analysis and classification. And if you use this particular robotic system for pesticide spraying, there is a chance of reduction of the loss due to misuse of the pesticides. So, this particular the usage you can make it very efficiently, very economically. The next is your the remote control and safety.

Now, this particular process of pesticide spraying will be done remotely and by doing that, there will be a less chance of exposure of the chemicals like the pesticides. So, it is not going to do any harm to the human operator. The person who is going to control that remotely, that particular robot while spraying the pesticide, he will be safe. Now, this data-driven

decision making process is also going to help us a lot. This experiment will be generating some data and this particular the collected data related to the plant health and disease prevalence will help us to do some sort of the crop management in a very efficient way so that you can improve the quality of the crop and at the same time, you can also increase the productivity.

So, by doing this particular experiment in the real field, we will be getting a lot of advantages, lot of merits and moreover, we are going to save the life of the human operator and these particular pesticides are a health hazardous pesticides. They need not spray in the real field which could be done by the robot and moreover, this particular collected data is going to help us to maintain an efficient data management system and this particular data management system is very much essential. If you want to improve both quality as well as the productivity. So, these are actually the merits of this particular experiment with the help of this robot that is tracked mobile manipulator. Now, while carrying out this particular experiment, a few precautions are to be taken.

Now, this experiment before we are going to carry out, we will have to decide the field where we are going to conduct that particular experiment. So, there must be some pre-planning of the field of experiment and we will have to ensure the surrounding wherever we are going to use this particular robot should be free, there should not be any such collision obstruction that type of thing. So, we will have to ensure the free surrounding for carrying out this particular the experiment. Now, whenever we are handling these pesticides, these pesticides are not good for the health. So, these pesticides are to be handled very efficiently by following the safety protocols.

Now, whenever we are controlling, so this particular the robot, its safety features are to be maintained like your whenever we are going to put that particular robot on, we will have to understand how to switch it off whenever the situation demands. So, the safety features are to be actually understood that means, your before you start the robot, we should understand how to stop it, if situation demands. Now, whenever you are running this particular robot, we will have to keep a close watch whether there is any vibration of the robotic joints, whether there is any such jerky movement of the robotic joints because if there is any such jerky movement or if there is any vibration, so that particular robotic joint is going to fail. So, we will have to ensure that the movement at the different robotic joints are smooth. And this particular design and developed robot is not suitable for the muddy field.

So, this robot should not be used, the robot which we have used for the experiment should not be used for the muddy field. For muddy field, we will have to design and develop another suitable robot. So, this is not applicable to the muddy field. Now, before we conduct the experiment, definitely calibration is required. So, calibration of the different joints movements and moreover the calibration of camera is also required.

Now, the next is as I told that there should not be any obstacle and that particular your surrounding should be free of other human being or free of obstacle. Now, this we will have to check the wireless connection between the camera, the way we collect the information that is the images collected with the help of camera, we try to bring it to the computer that particular wireless connection and the wireless connection between the control unit and the real robot, we will have to check whether they are working properly or not. There should not be any overheating of the motor or battery. So, we should operate this particular robot within the capacity of that particular the battery mounted on the robot and moreover the overheating of this motor has to be avoided. Now, generally if there is any such mechanical disturbances like your if there is any jerky movement vibration that may create some friction, overheating and all such problem.

So, we will have to be careful that type of problem should not be there. Then comes your the maintenance of the robot. Now, there must be a pre-planned preventive maintenance for the robot and at a periodic like your at a gap of some pre-defined period, this preventive maintenance has to be carried out for this particular robot to avoid the failure while using in the real field. And of course, the operators are to be trained. So, training is required to the operator, the operator so that he can operate this particular robot in a very efficient way.

So, these are the precautions are to be taken like if you want to carry out this particular experiment in real field in a very efficient way. Now, we have understood that this particular the robot that is a tracked mobile manipulator has got a lot of merits, but this particular merit will be able to utilize it properly if and only if we take all the precautions while carrying out this particular the experiment. Now, here in this particular experiment, we showed you how to use this tracked mobile manipulator to do classification, then disease detection, then spraying pesticide. Now, the similar type of robot can also be used for watering the plant like it will try to find out whether we need the watering or not, whether the soil has become dry, then watering has to be done. So, the similar type of robot or the same robot can be used for watering the plant, then comes here.

This robot can also be used to identify the shape, size and quality of the fruits and the fruit picking that particular task can also be done with the help of this tracked mobile manipulator. Now, these are some of the references, you can have a look to get more information regarding this type of agricultural robots. Thank you. .