Moving Robot on Tree Branches

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Abstract- This paper presents a simple model of moving robot on tree branches. We use the helicopter to move the robot with of pruning mechanism from the ground up to tree branches. So the robot can move on long branches and prune them. In this paper, the design of the mechanical equipment and simulation using Inventor Software will be presented.

Keywords: brachiation, arms swinging, linear motion.

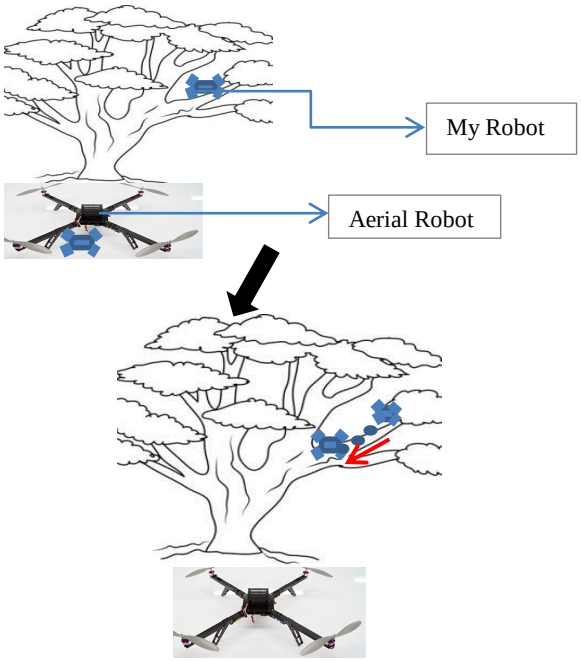
1. Introduction

In the modern world, the robot has involved in a lot of human activities and become a part of human essential. It takes not only part of simple tasks such as robot vacuum cleaner [1], or robots cleaning house[2] but also for a heavy task like manufacture a car [3] or shipway [4]. It helps people to make their jobs faster, save time more and safer, particularly in dangerous situations[5]. There are types of robot in the industry where each one of them has a specific function and unique to each other.

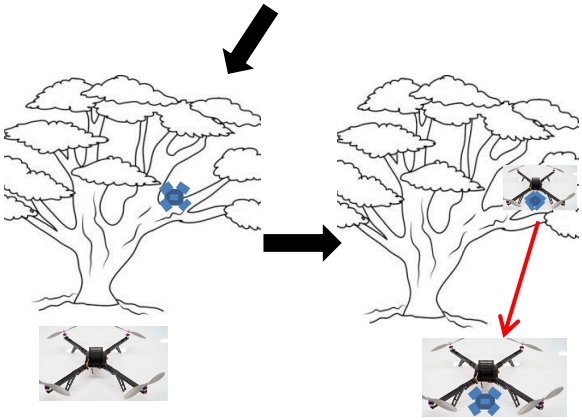
Forest pruning is also a task very difficult and strenuous. It is a vital aspect of the forestry industry that helps to increase high-quality wood, contributes to the maintenance of forest environments and especially reduces the accident rate in the forestry sector. To improve high-quality wood, we need to prevent insect and decay organisms from entering the tree by removing dead, damaged and diseased on the tree. Therefore, the tree will have a dense canopy of a tree to increase air and sunlight, resulting in fewer disease problems. Beside that this prevents the branches from splitting and tearing wood that is often a problem in heavy winds. Correct pruning procedures create and maintain a strong tree structure, preventing safety hazards such as low-growing branches and growth forms subject to storm damage near a sidewalk or driveway. Often erratic or vigorous branches grow that change the growth habit of other branches, this result is in a misshaped tree. Early removal of these vigorous branches maintains a natural tree form [6]. Cutting tree branches is a dangerous task. A forestry worker doing cutting must climb high trees, support their body with one hand while and cut branches with the other hand. Therefore, the development of robot is necessary to replace manual work.

To solve this problem, we will use an aerial robot to move a robot with of pruning mechanism from the ground up tree branches. So the robot can move on long branches and prune them. My research is to design a robot move on the tree branches. I will design the mechanical system and perform some experiments in a test bed.

Step 1: Aerial Robot brings Robot from the land to tree branch. Then aerial robot comes back the land.



Step 2: Robot moving on a tree branch



Step 3: Robot cuts tree branch

Step 4: Aerial Robot brings Robot to land

2. Mechanical design of Robot

In mechanical design include the conceptual design of the robot and assembly process.

The overall test design of the robot is as shown in Fig.1. The main structure consists of three parts: 1/Front gripper, 2/ Locomotion body, 3/ Gear gripper.

The conceptual design of complete robot created by using Inventor software. This design is using a modular mechanism to perform its locomotion.

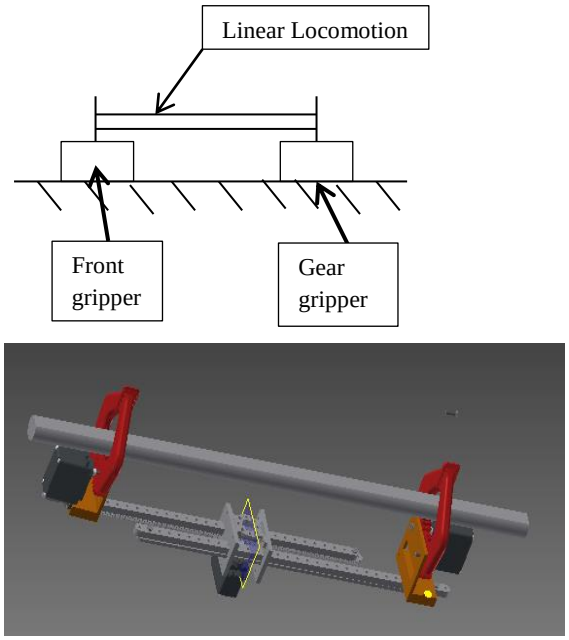


Fig.1 Conceptual design of complete robot

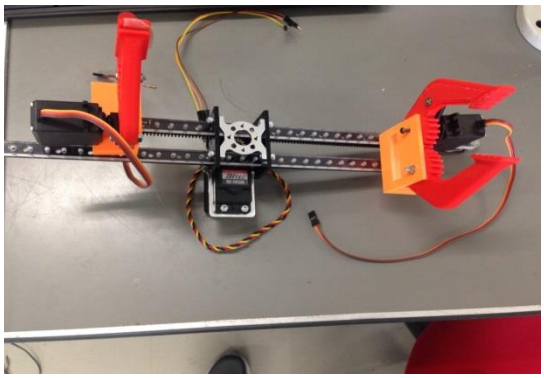


Fig.2 Complete Real Robot

2.1 Gripping module

Fig. 3 shows the gripping module part. There are two gripper modules, which are the front gripper and the rear gripper. Each gripper composed of one servo motor which attached to the base of the gripper.

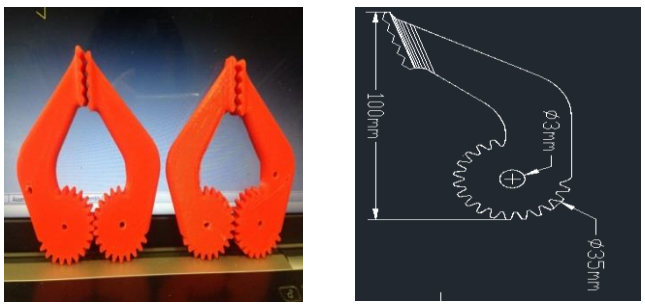
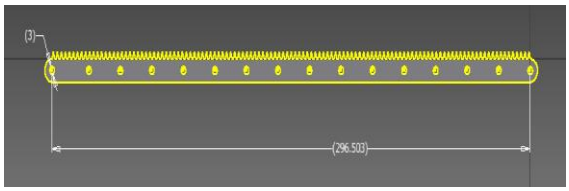


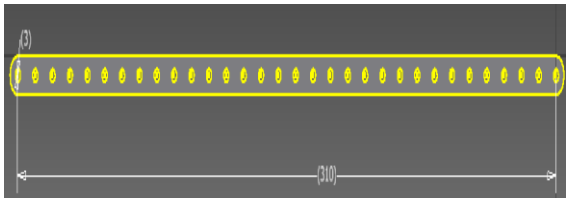
Fig.3 Gripper module

2.2 Body robot module

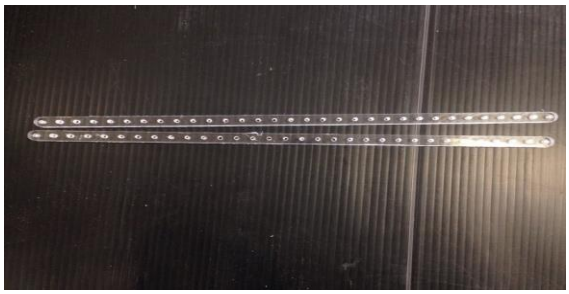
(1)



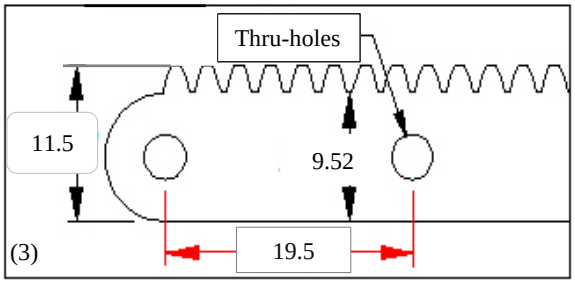
(2)



(3)



(4)



(1): Bar
(2): Rack Gear, with 118 teeth
(3): Size Rack Gear detail
(4)Bar and rack gear using CNC machine

Fig.4 The moving module part

2.3 Motor selection

In this work, RC servo motor with metal gears has been chosen as the motor for the climbing module and gripping module because of high torque and easy to control. Table I shows the specification of the motor that was used to control the movement of the robot.

Table 1: Specification of motor

Motor	Specification
RC servo motor	○ Speed (sec/60deg): 0.22/4.8V ○ Torque (kg-cm) : 9.0/4.8V ○ Size (mm): 40.8x20.18x36.5 ○ Weight (g):55 ○ Rotation angle: 180 degree

3. Motion of robot

The locomotion of robot is similar to brachiation or arm swinging which is a form of arboreal locomotion in which primates swing from tree limb to tree limb using only their arms. During brachiation, the body is alternately supported under each forelimb. [7]

Fig.5 shows six steps of the robot when it moves on a tree branch. The square colored in white represents the closed gripper that attached on the substrate while the square colored in blue represents the opened gripper that detached on the substrate. The order of motion in the Fig.4 represents the locomotion of moving forward.

4. Working on robot

The robot designed is made to follow the following algorithm to move it in a tree branch. The following algorithm describes the basic motion of the robot. The Fig.6 shows the overall program of moving robot.

The Arduino Uno is used as the processing unit to control 3servo motors.

5. Conclusion

A linear locomotion was discussed. The gripper designed using 3D printer technology of the first prototype and couple grippers will be controlled by using servo motor and Arduino board.

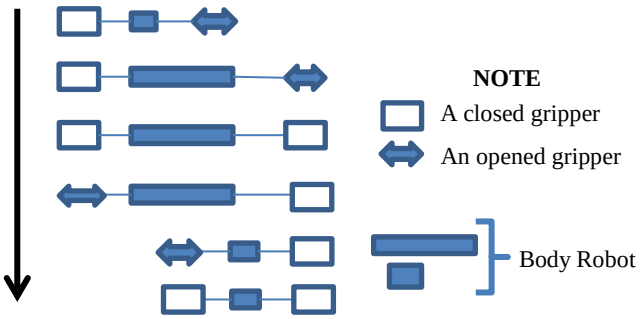


Fig.5 Locomotion of Robot

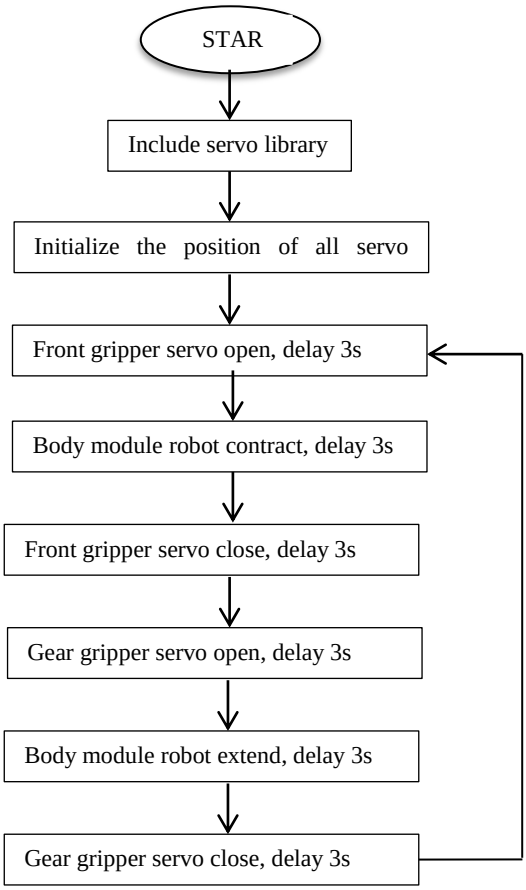


Fig.6 Flowchart of overall

6.References

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