Spider Animation

Getting up close and personal with a virtual spider using the Oculus Rift

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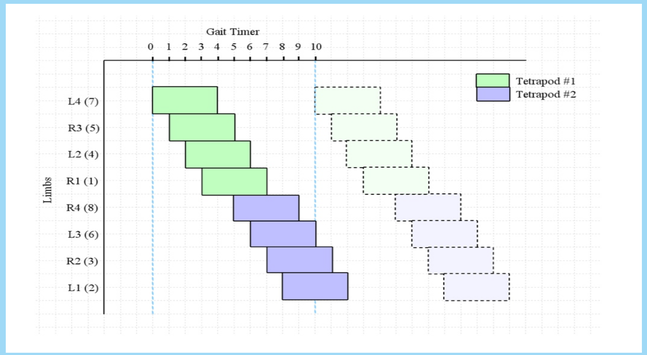
Introduction

The main aim of the project is to develop a plausible spider animation by using knowledge from biology and robotics. A simulation of this kind could be used in various meaningful scenarios such as psychological experiments to help with fear of spiders, or purely for entertainment purposes.Oculus Rift is used to enable users immersed in the animation.

Knowledge from Biology



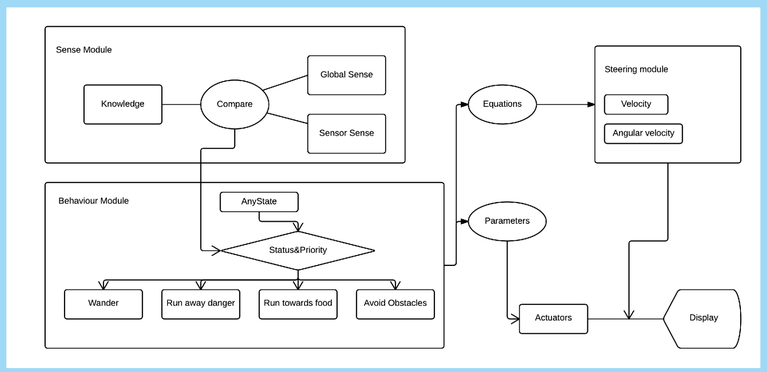
Knowledge from biology especially about limbs' movement is required to make animation plausible.

Wilson[1] proposed five rules of the gait behavior of many insects.

Figure 1 is alternating tetrapod gait cycle based on the rules above.

Figure 1. Alternating tetrapod gait cycle.
Cenydd, L. A. Permission from author. Image from "An embodied approach to arthropod animation".

Main System Design



The main system is based on three layers architecture [2] and subsumption architecture[3].

Figure 2. System Design

Knowledge from Computer Graphics

Figure 3. Animation Pipeline.

This project adopts skeleton animation technique. Images from left to right in figure3 are rigging, skinning and produce animation clips in Blender. The other two images are examples shown in Unity. The green lines in the fifth image are the eye scope of the spider.

In terms of producing animation clips in Blender, there are two choices: one is to produce long animation clips for the whole model. The other is to create animation clips for each part of the model which are then combined. The advantage of second choice is that the system will be more flexible. The second method is chosen for this project.

Results and Discussion

Figure 4. Spider run away from danger

The left image in figure4 is a scenario where a spider sense danger. On the right side, the four images in first row show the spider walk back from the danger and the ones in the second row show the spider turn around.

The biggest shortcoming is the animation is not consistent with the kinematic variables and there is not a strong relation between speed and angular speed.

Conclusions

In this project, knowledge from biology, robotics and computer graphics are used. Experiments between long clips method and short clips method are done and short clips method is chosen to make the spider animation system more flexible.

The spider'smovement is a little inconsistent which could be tackled by improving the relation between steering module and actuators. Foot sliding problem could be solved by IK.

[1] Wilson, D. M. Insect walking. Annual review of entomology 11, 1 (1966), 103–122.
[2] Reynolds, C. W. Steering behaviors for autonomous characters. In Game developersconference (1999), vol. 1999, pp. 763–782.
[3] Brooks, R., et al. A robust layered control system for a mobile robot. Robotics and Automation, IEEE Journal of 2, 1 (1986), 14–23.