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Project Description

The purpose of this project is to make a linkage driven quadrupedal robot with the ability to steer. Recently, there has been increased interested in quadrupedal robots for traversal of rough terrain at high speeds. Most often these robots are driven by a large number of expensive and heavy actuators. Linkages could offer a simpler, less expensive, and lighter means for driving quadrupedal robots. In addition linkages can be used to obtain high mechanical advantages allowing large torques to be obtained from high speed electric motors. Various linkage driven quadruped automata have been produced before, but they have lacked the ability to steer.

To simplify prototyping of our robot, we used Lego. Our design is based on the quadruped designed in "Exploiting Body Dynamics for Controlling a Running Quadruped," by Iida et al. The quadruped described in the paper used four hip mounted servos to apply a sinusoid input to compliant legs to attain a bounding gait. Even though this system was simple and was completely open-loop controlled it was shown to be self-stabilizing. Because each of the servos was just going through a sinusoidal path, it is highly amenable to redesign to utilize linkages. In order to attain this sinusoidal motion we use rocker cranks on each of the legs driven by a centrally mounted motor driven gear. By changing the position of the link on the gear we are able to adjust the phase the legs with respect to each other. During testing of our prototype, we found that our Lego motor did not have enough power to obtain a proper bounding gait, so we tried a trot gait instead by readjusting the phasing of legs. This turned out to be workable with the motor we had. However, this gait turned out to be slightly unstable, to address this we added a rotational mass-spring-damper to the front of the robot, the white head structure at the front of the robot. This is known as wobbling mass and has been found to aid in the stabilization of passive dynamic quadrupeds.