Mechanical Design

The major mechanical components of the robot are the legs and the chassis. The legs are further broken down into the thigh and the shank. The constraints placed on the mechanical design include the overall dimensions, weight, and carrying capacity of the robot.

The chassis of the robot is designed to support the legs while in motion, as well as serve as the housing for the pneumatic and electrical components. The choice to use 6105 –T5 T-Slotted Aluminum framing for the chassis was due to the simplicity of construction. With a number of connection plates and brackets available, a simple chassis would be easy to construct. In addition to its simplicity, the Aluminum framing is lightweight, fulfilling the robot’s weight constraint, and strong enough to support the forces exerted by the pneumatics during operation. Custom hip joints will need to be designed to be able to easily attach the legs to the outside of the frame. Additionally, mounts for the pistons will need to be created in a similar fashion.

The design of the legs is based on the anatomy of quadruped mammals, more specifically dogs. In order to reduce the robots complexity, the number of joints in the legs was reduced from three to two. In order to compensate for the loss in range of motion, the thigh was designed with a bend in it. The bend allows for a shorter stroke length for the pneumatic cylinder. This in turn, means that the cylinder can be attached closer to the hip joint on both the body and the thigh. The bend in the thigh is also beneficial in that it prevents the piston controlling the rotation of the knee joint from reaching a singularity point and possibly seizing. The design of the shank is much simpler. One factor that helped to determine the lengths of the thigh and shank was the desired step length. Similar to the body, the legs will most likely be constructed using an Aluminum alloy. A specific material is yet to be determined and will be based on the required strength and machinability of the design.

As a means to ensure the design would be handle the forces due to the weight and pistons, an initial FEA analysis was run. Each component was tested separately, using the worst case scenario as an upper limit test of the structures: Trying to move at maximum velocity using the slowest gait with the joints seized. Under these conditions, the components hold up, meaning the designs should be more than capable of handling normal operating conditions.

