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To further understand the background of my project and determine the direction for the project, I searched for academic papers on the topic of soft robotics. My advisor pointed me to an annual conference called RoboSoft, where modern developments in the field are presented in summarized papers, and luckily details on the papers presented in previous years of the conference are stored on IEEE’s website. Overall, I explored between 40 and 50 papers, categorized into papers on actuators, airflow dynamics, grippers, joints, material studies, and tensegrity.

Initially, we considered implementing a pneumatic system, so we looked into past literature that involved designing robots, unique actuators, or joints that utilized pneumatics. One particular paper titled “Increasing the Dimensionality of Soft Microstructures through Injection-Induced Self-Folding” detailed the creation of a soft, spider robot that relied on hydraulics; although it isn’t the same as pneumatics, it provided a lot of insight on the design process and how they handled using fluid pressure to actuate the joints of the spider. However, during this process, I realized that if we were to design a robot using pneumatics, we would need at least two “pipes,” one for supplying pressure, and the other for removing pressure, in order to control a pneumatic system. This would prevent us from creating a completely tetherless system, unless we somehow added a compressor directly onto the robot design, and since we wanted to create a small robot, it would not be feasible. Although I wasn’t against the idea of having a near-tetherless robot, I wanted to try and see if I could find a way to make it tetherless, and less prone to error due to pressure leaks and having to set up a pressurized system.

After this realization, I pivoted towards researching methods on design that didn’t use pressure to operate. One such method that I came across was detailed in “Design and Fabrication of 3D Papercraft IPMC Robots,” where the authors designed a turtle shaped robot whose fins operated on high voltages and specially made fins. Another method was introduced to me in the paper “A crawling robot driven by a folded self-sustained oscillator.” In this paper, the authors used a small DC motor to oscillate between pulling two strings on top of a paper robot, and when the strings are pulled, they cause the robot to move, due to preshaped bends in the legs. The latter’s design seemed more feasible for us to implement, given the equipment we have in our lab, so I continued to search for other similar projects.

Eventually, I came across the paper “Untethered Cable-driven Soft Actuators for Quadruped Robots.” The paper describes how the authors made a cable-driven, quadruped robot using soft actuators that are similar to ones that our lab has made in the past. After seeing this, I wanted to try using these actuators as well, to see if I could design them to be similar to flippers for our robot, which we wanted to model as a turtle. With this, I decided to pursue the idea of creating a cheaply replicable, cable-driven, tetherless robot in the shape of a turtle, with the initial focus on actuator design.