Introduction to Robotics ME 639: Industrial Project Presentation 2

Project Title: Pill Picking Robot

Team Name: Bots

Team Members: Shardul, Prathamesh and Nikhil

Instructor: Prof. Harish PM
Teaching Assistant: Suraj Borate

Problem Statement:

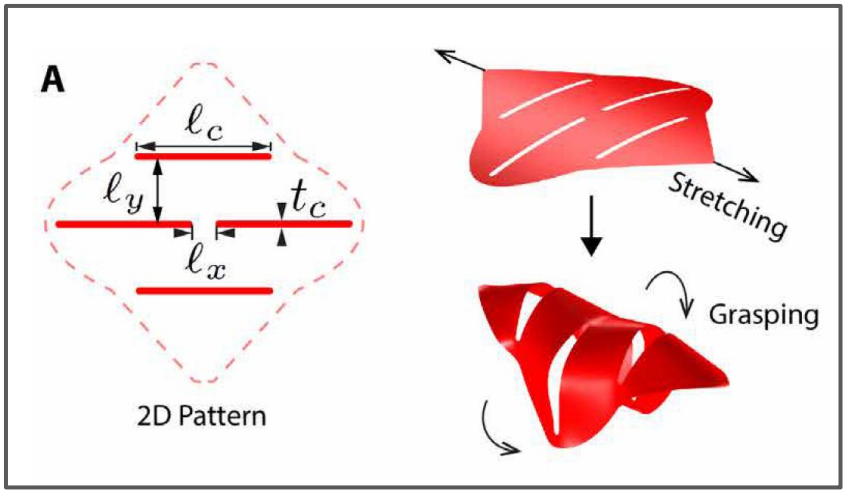
“To design a gripping/picking mechanism to reliably pick one-and -only-one pill from an open cup containing only one type of pill of which type, size and weight will be known a-priori. ”

Industry name: **Timetooth Technologies Pvt. Ltd.**

Objectives:

- Pick a pill of known dimensions from a cup
- Only one pill has to be picked at a time
- To design a control system for the picking mechanism
- To design reliable gripping mechanism

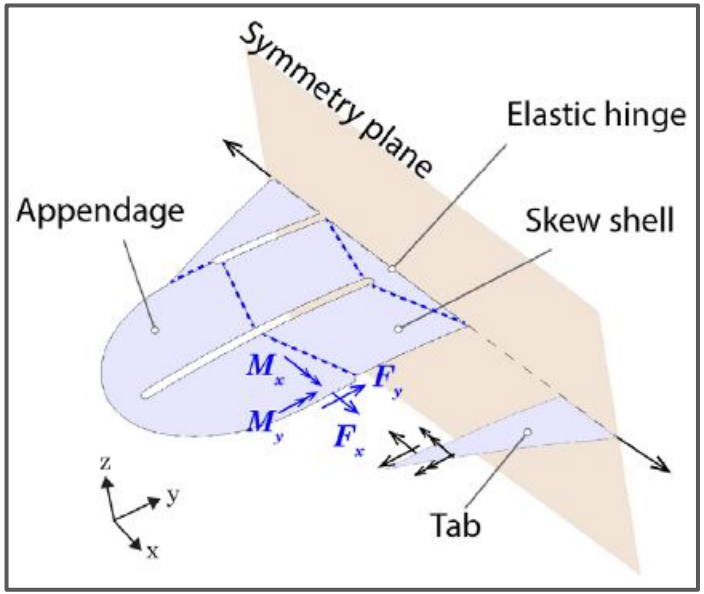
Rationale / Approach / Ideas:



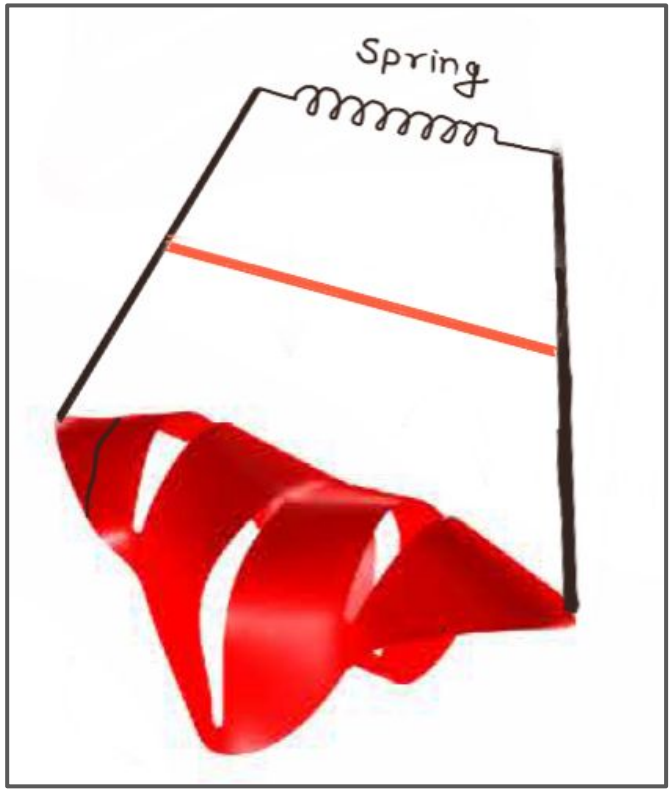
- Sheet of PET(polyethylene terephthalate) material is used in fabricating Kirigami shells along with slits using a laser cutting technique. These slits are enabling the grasping motion.
- After cutting the shell, it is held on curved surface and heated for an hour to provide with finite curvature.
- This cylindrical curvature with a finite magnitude would trigger the shell to warp into a cylindrical surface upon stretching.
- Deformation of the shell does not depend on the size or overall geometry but is governed by the geometric parameters like l_c, l_y, l_x and t_c. These parameters also contribute in the bending energy of the kirigami shell.

Force Analysis:

- On the basis of deformations of kirigami shell, we decompose the kirigami shell has three structural components:
  (i) two handling tabs
  (ii) four skew shells (parallelogram shells)
  (iii) Elastic hinge
  (iv) two appendages
- The diagram shows the forces and moments applied on the gripper.
- A pulling force is applied on the tabs drifting them apart bending the gripper at he elastic hinge.
- Due to this, the appendages come closer to grip the pill.
- The skew shell separates apart creating a bend in the flaps of the appendages, helping to grip the pill with greater contact area.

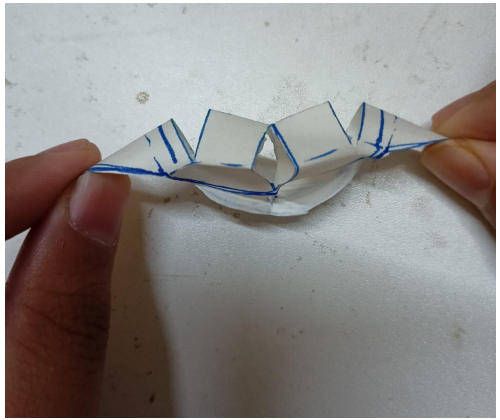


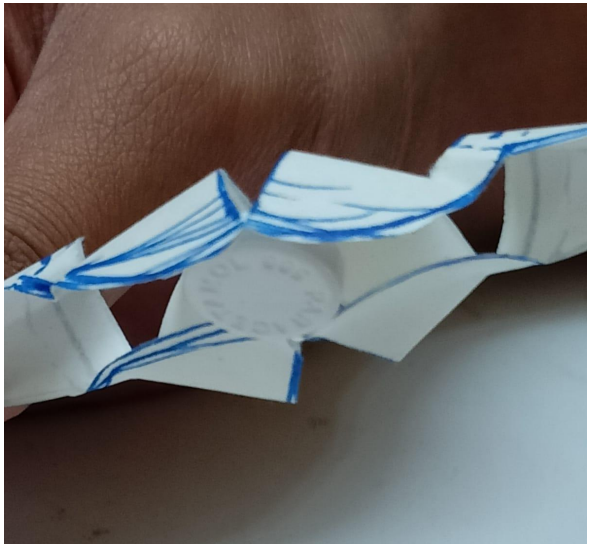
Supporting Mechanism :

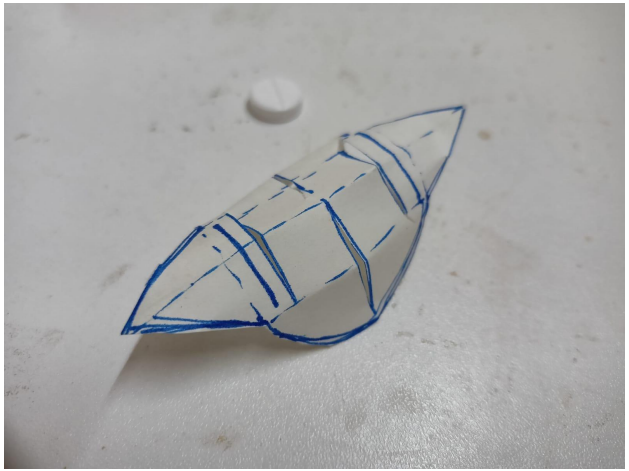


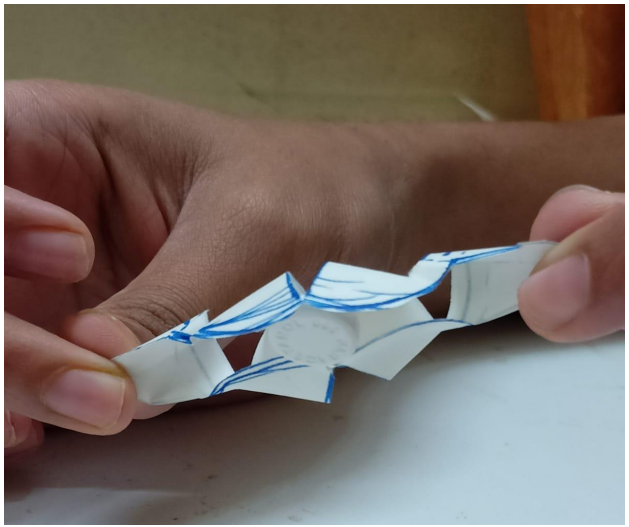
- A mechanism that will always rest the gripper in closed state when no actuator force is applied to ensure that the pill stays in the gripper is to attach
- The mechanism consists of a simple H shaped frame, a spring on one side and the gripper on other side.
- In the natural state, spring pulls the two links closer resulting the kirigami gripper to close.
- To open the gripper, the actuator will apply force opposite to the the spring force.

Key Results 1:









Insights / Interim Conclusions / Discussion:

- The results of the experiment shows that the gripper is capable to pick the pills reliably.
- The material needs to be flexible but strong as the stress is more on the narrow parts of the gripper.
- The size of the gripper has to be adjusted such that the gripper can only hold at most one pill at a time.