— Design and Manufacturing II (2025) Course Project Exhibition —

Project title: Jumping Robot (Grasshopping / Jumping Robot)
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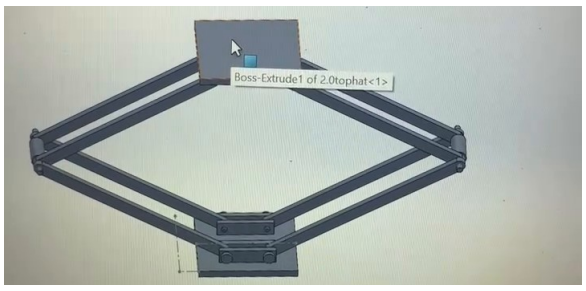
Group: 8

I. Project Introduction

1. Background

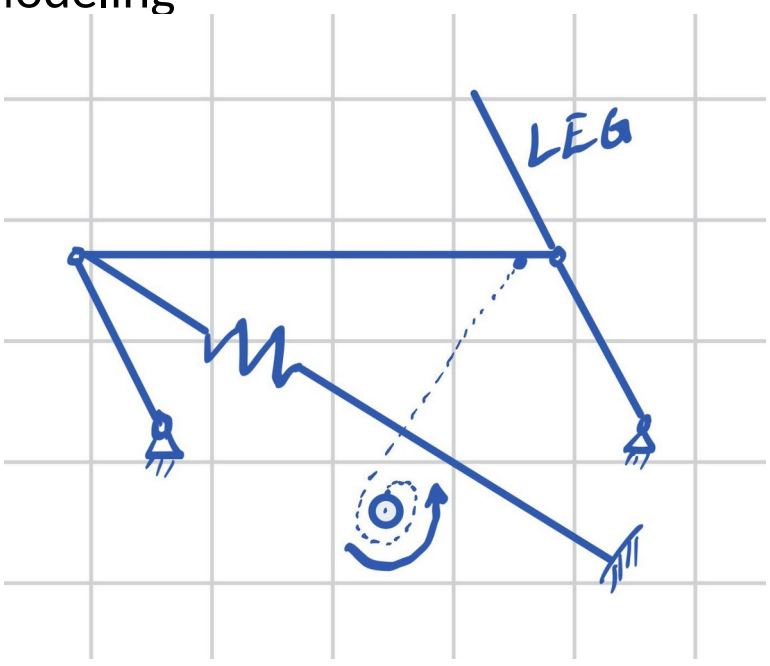
Bio-inspired jumping enables rapid locomotion and high obstacle clearance with minimal contact time. This project develops a compact jumping robot that stores energy in extension springs and releases it via a triggered latch for repeatable jumps.

2. System Concept



The robot employs a two-leg four-bar linkage that amplifies stored spring energy into a fast extension at the foot. A geared motor charges the springs through a compact latch; the latch is released to initiate a jump. The design prioritizes low mass, modularity, and rapid iteration with 3D-printed components.

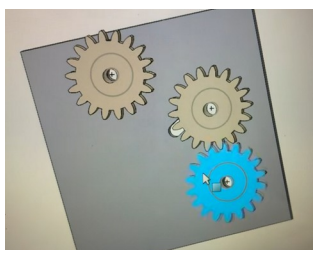
3. CAD Modeling



CAD models were used to verify kinematic range, clearances, and joint alignment, and to define print-ready subassemblies. Simple simulations guided link lengths, knee angle limits, and ground-contact geometry prior to fabrication.

II. Prototype Fabrication

1. Energy Storage & Release



Two extension springs mounted near the knee store mechanical energy while the legs are drawn into a crouched configuration. A planetary/spur reduction provides sufficient torque for quasi-static charging, while the release mechanism decouples the motor at take-off to reduce losses. The trigger enables consistent release timing.

2. Manufacturing & Assembly

Most structural parts were FDM-printed; load-bearing interfaces were reinforced with steel pins and standard fasteners. Critical holes were drilled or reamed after printing to improve alignment and reduce friction. The prototype was assembled in modules to support fast repair and parameter tuning.

III. Key Innovations

The final prototype integrates energy storage, release, and leg linkage in a compact envelope, enabling repeatable crouch–release cycles. A simple latch architecture and modular printed parts accelerate iteration. The hybrid build process combines additive manufacturing with basic machining for accuracy at key interfaces.

Acknowledgements

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