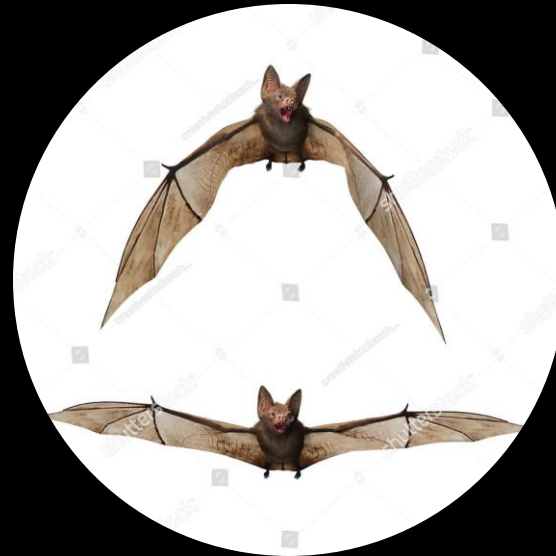
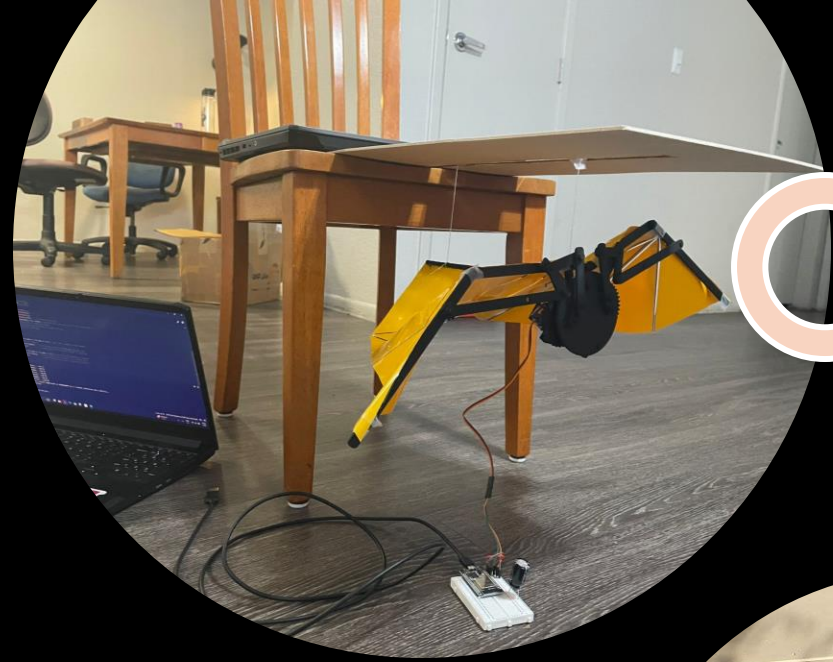


From BATS to BOTS



PROJECT GOALS

Question for Research:

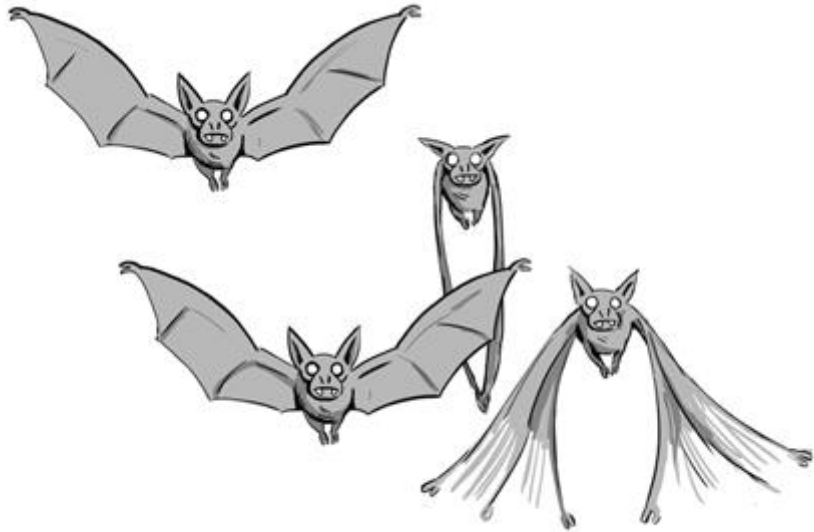
How can multi-modal robots intended for aerial mobility improve their speed and agility during terrestrial locomotion through optimal actuation and gait pattern strategies?

Focus: Bat gliding dynamics.

- Examine the biomechanical characteristics, wing shape, and aerodynamics of bats.
- Stress the importance of energy-efficient gliding.
- Create robotic system with a bioinspired design.



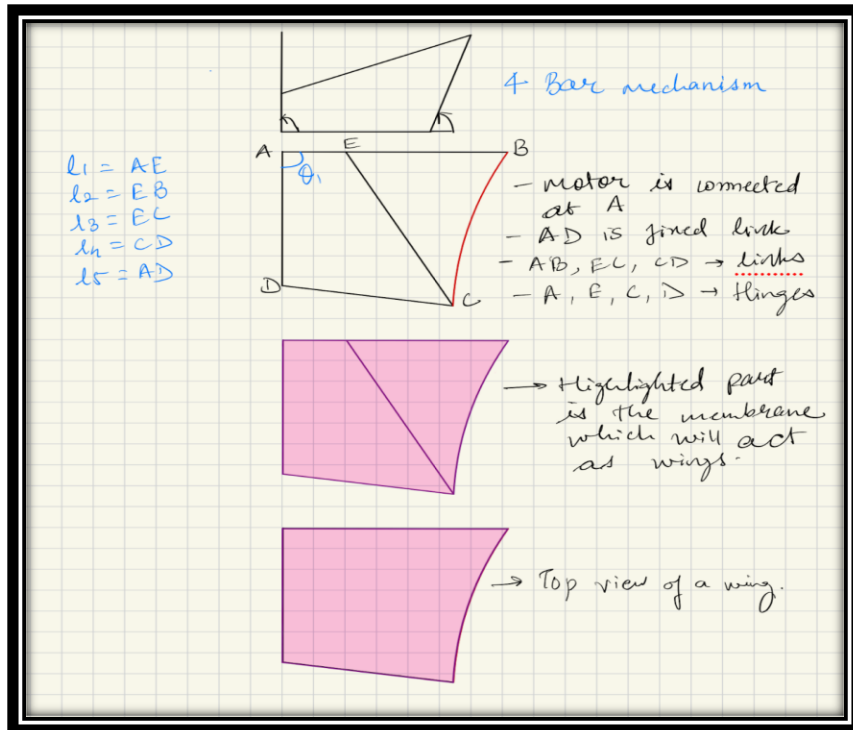
SCOPE OF RESEARCH



1. Examine the bat's gliding mechanics.
2. Anatomical changes for energy-efficient gliding should be the main focus.
3. A better understanding of robotic applications for crowded spaces.
4. Enhance the control algorithms and drag-to-weight ratio.
5. Energy-efficient design with a focus on wing material selection.

Bio-Inspiration

- The MultiMo-Bat combines gliding and leaping.
- Steered gliding with impact energy reduction is the EPFL Jump-Glider.
- Bat Bot (B2): A soft robot with biological inspiration that mimics bat flying.



Key Design Elements

- 4-bar hinge-jointed mechanism.
- surface of a thin membrane for controlled glide.
- Wing actuation using servos for accurate movement.



PROTOTYPING PLAN



Put the actuators, wings, and frame together.

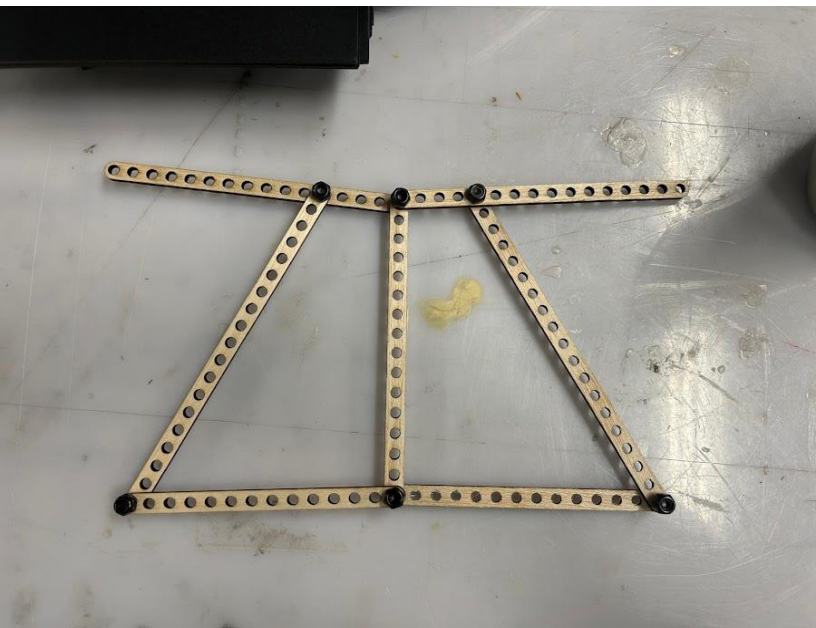


Pay attention to the mechanisms for folding and wing actuation.

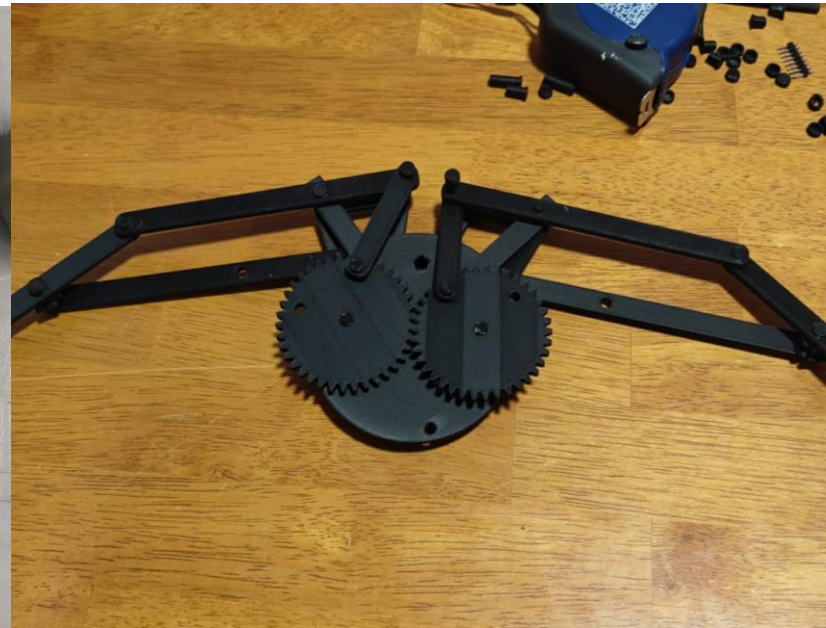


Make use of modular design to facilitate assembly.

Initial prototype



Improved mechanism

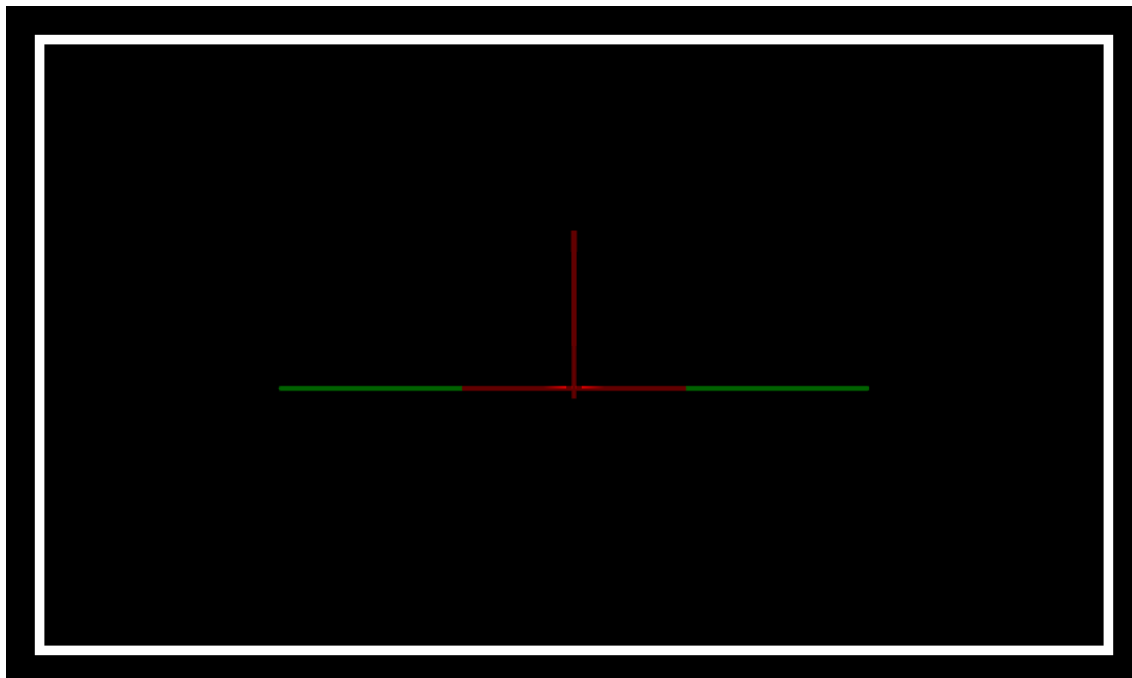


Final Prototype



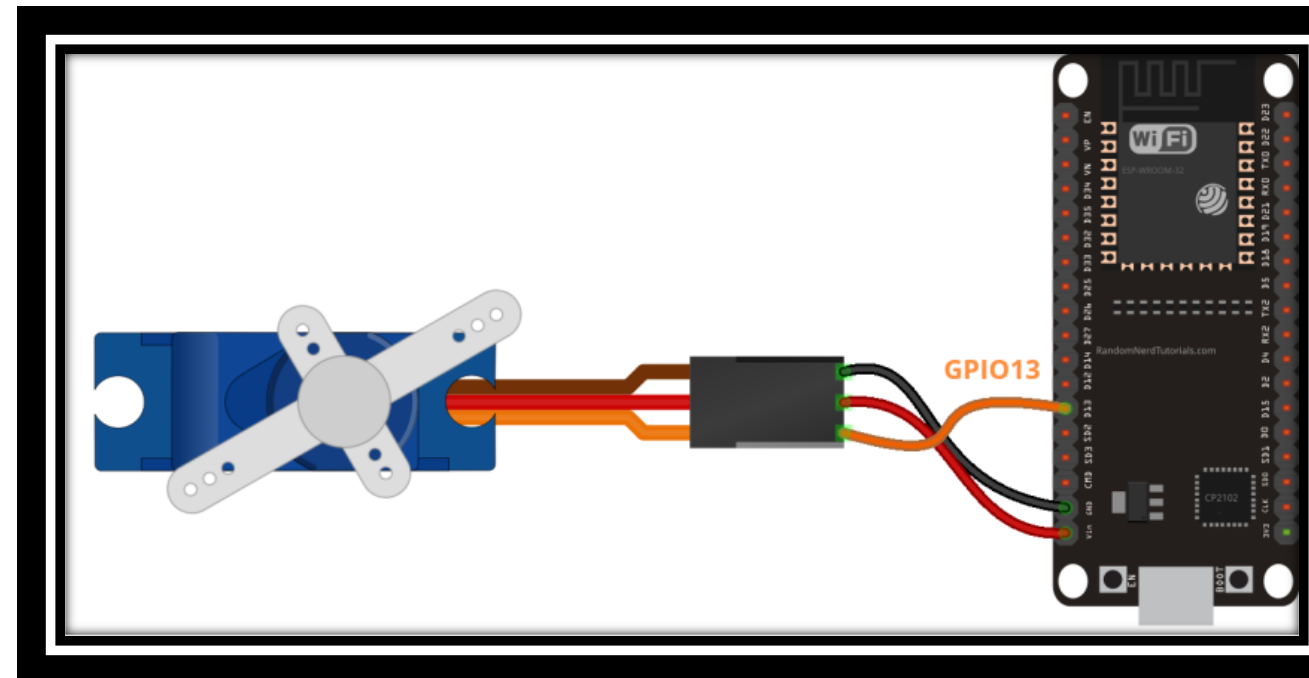
Techniques implemented

- Tools that are symbolic for optimization and restrictions.
- low-cost motion-capture prototyping.
- simulation with compliance modeling and MuJoCo.
- strengthening the ideas of 3D vectors and kinematics.
- energy-efficient design with a bioinspired aesthetic.



CIRCUITS USED

- **Microcontroller Used:** The circuit incorporates an ESP-32, which serves as the central processing unit or "brain" of the mechanism.
- **Actuator Integration:** The ESP-32 is connected to a servo motor that facilitates the rotation of gears.
- **Mechanical Functionality:** The rotating gears, driven by the servo motor, enable the movement of the wings.



FINAL OUTCOMES



Video: <https://youtu.be/ZdsJeafwBmk>

- Research advances knowledge of robots inspired by bats.
- An innovative strategy for flight that uses less energy
- Ideas for improved robotic systems that are bioinspired.
- Prototypes are used to illustrate practical applications.
- A bio inspired mechanism that uses classical four bar mechanism to generate force to successfully flap the wings.