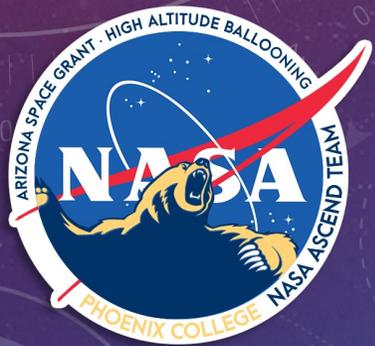


ACTIVE STABILIZATION FOR IMAGING DEVICES

NASA ASCEND – PHOENIX

BRIAN MORENO¹, MEGHANN BOLAND²,

JESSICA FRANTZ³, EUNICE LOPEZ⁴, MAXX MUDD⁵



THE IMPORTANCE OF VIDEO



RESEARCH



GENERATE
PUBLIC INTEREST



RECRUITMENT
TOOL



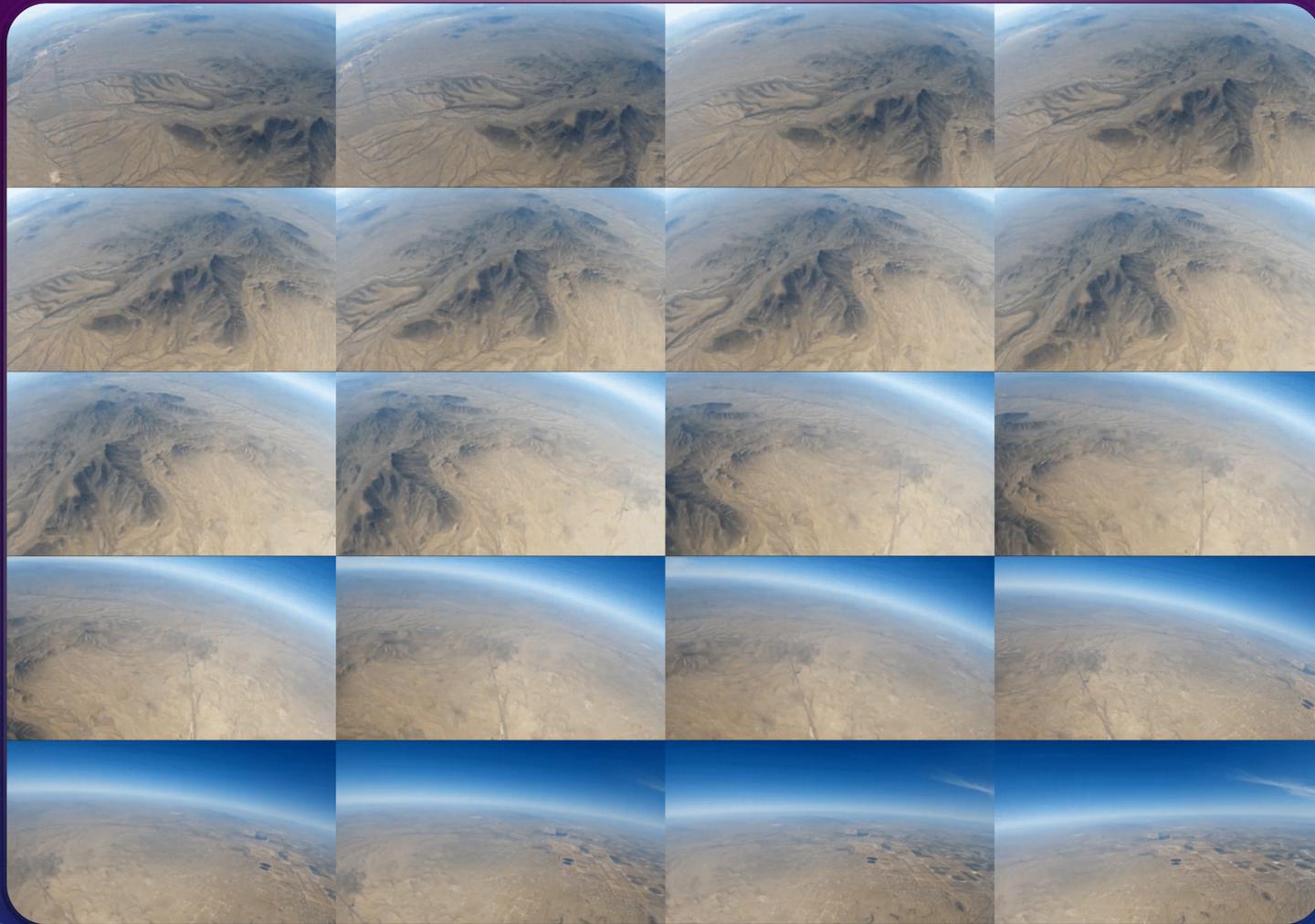
FINANCIAL
SUPPORT



TIMELINE OF
EVENTS

THE PROBLEM OF SPINNING





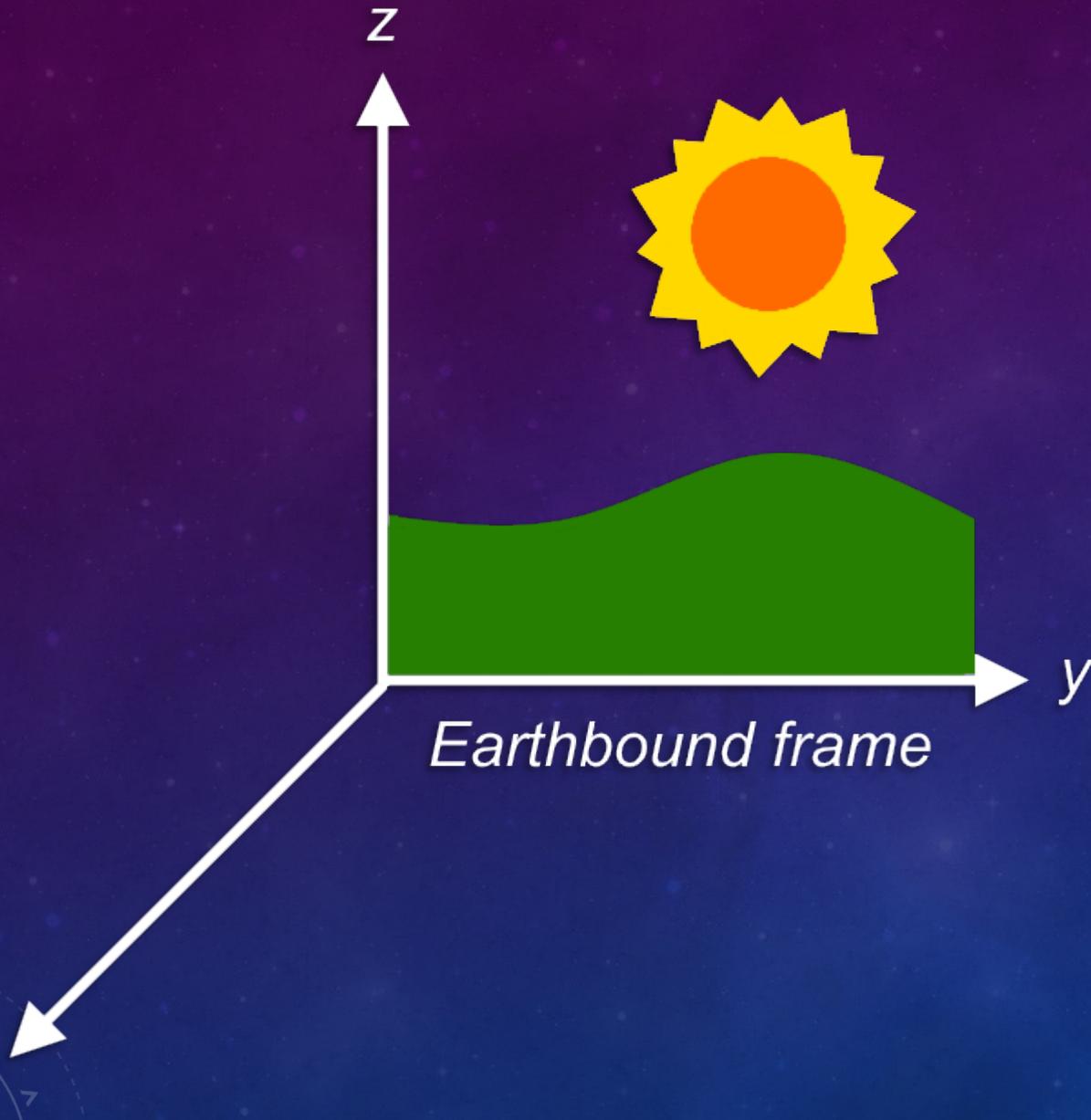
MAIN CAUSES

- Drag – Aerodynamics
- Tether – Characteristics
- Wind – Weather
- Momentum – Weight

KEY
INFORMATION

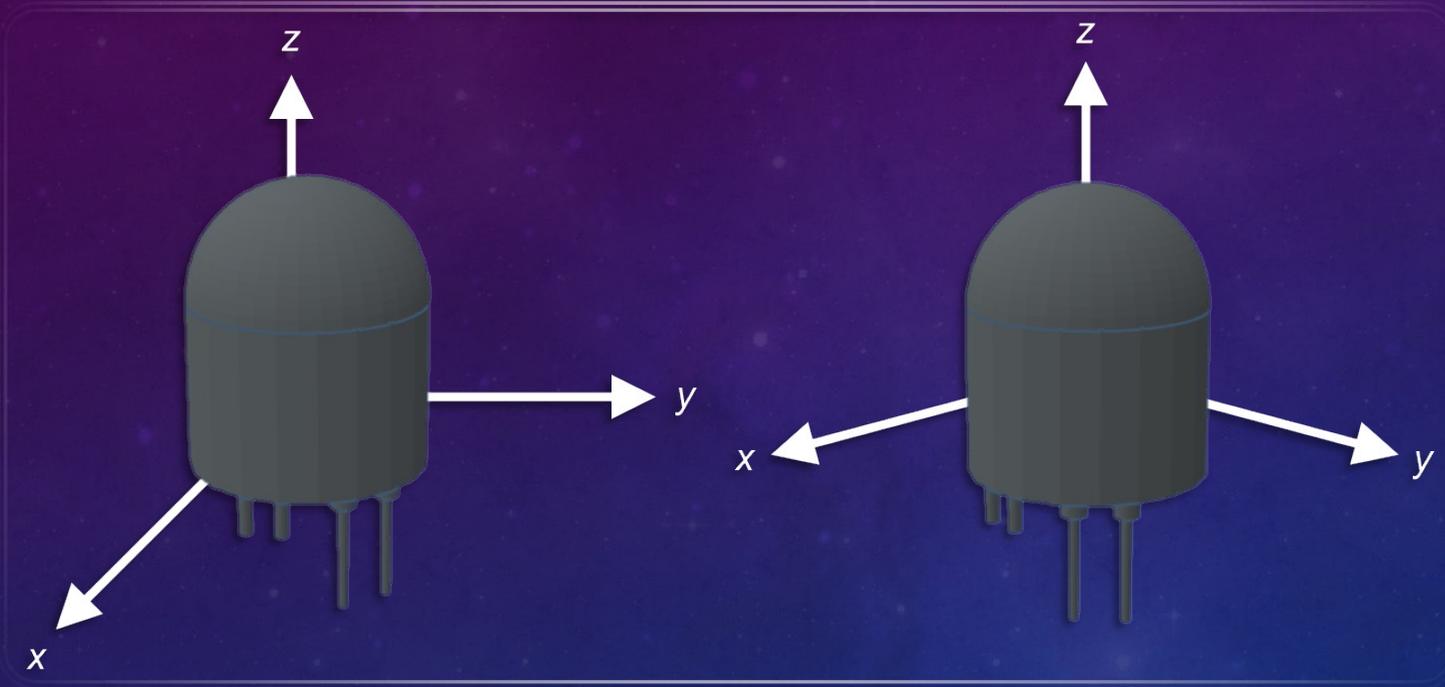


FRAMES OF REFERENCE

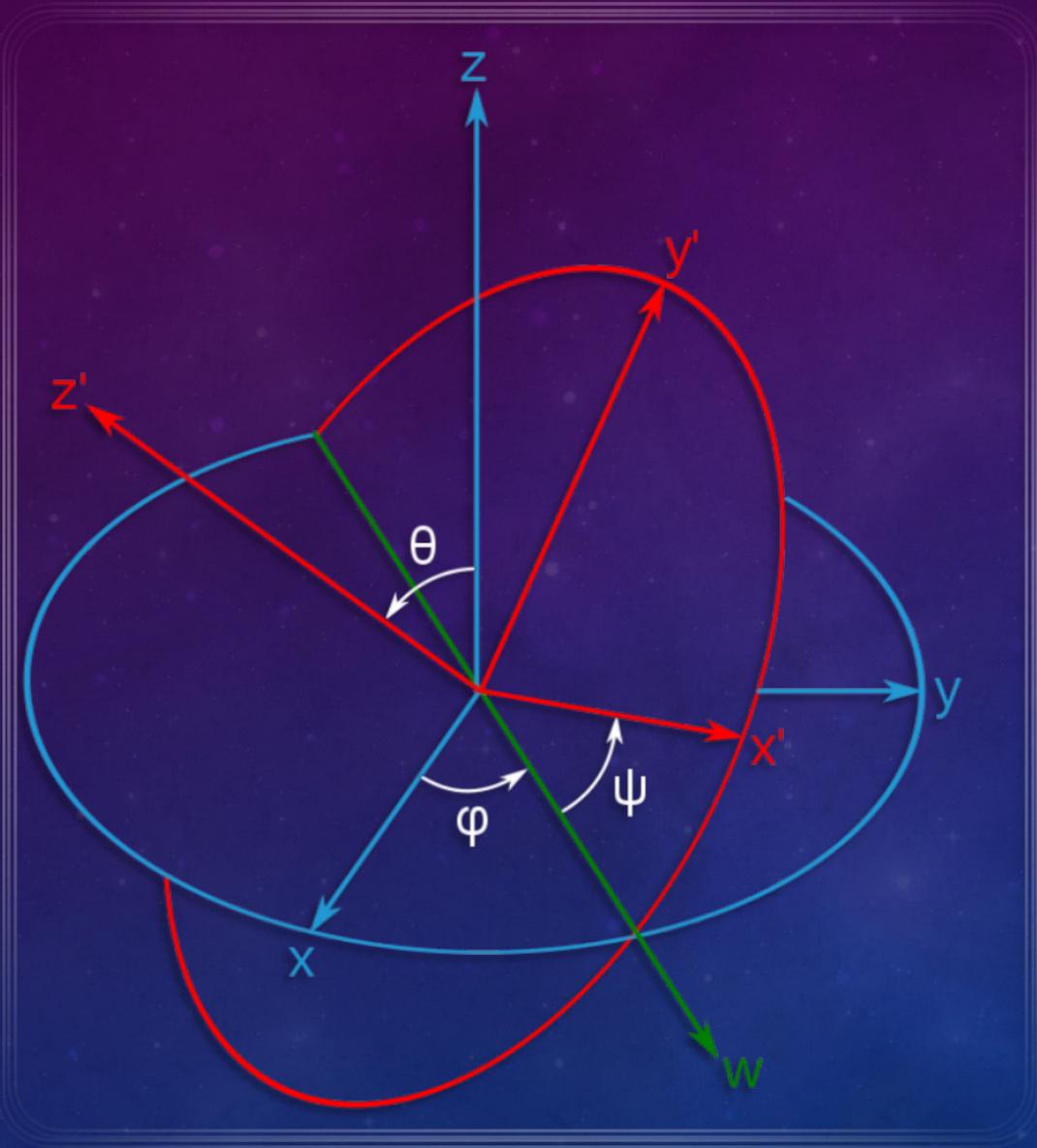


- Earthbound frame
- Relative to Earth
- Many types of Earth-based references
- Z-axis set perpendicular to the ground
- For understanding orientation compared to Earth's surface

FRAMES OF REFERENCE

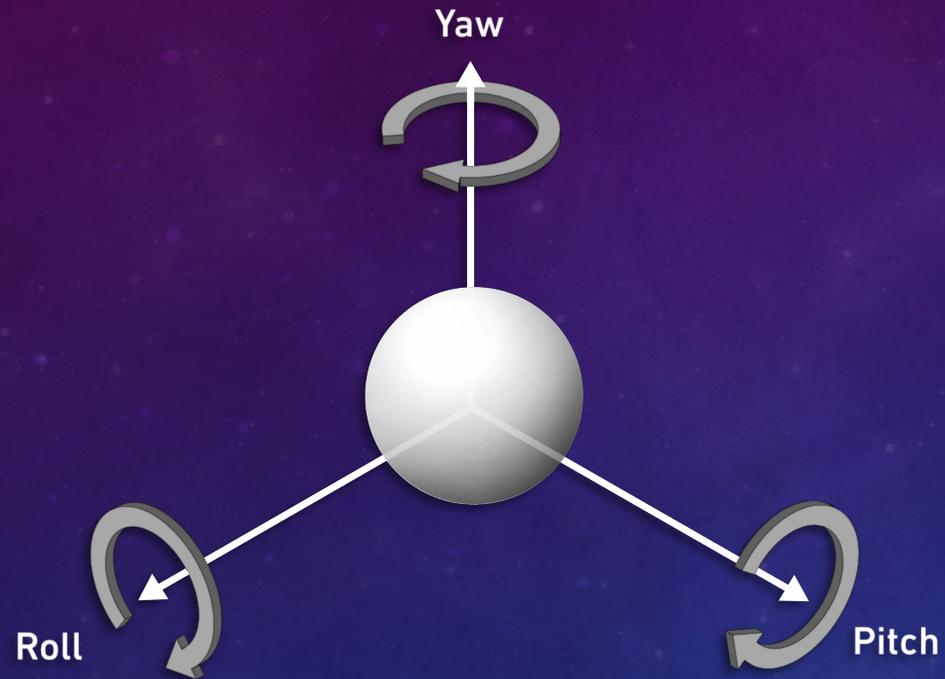


- Inertial frame
- Fixed on the object
- Perceived as independent of external causes
- No acceleration
- Needed to interpret motion



EULER ANGLES, QUATERNIONS

- Angles to define any orientation
- 3 steps in x , y , and z
- Gimbal lock problem
- Conversion to quaternion



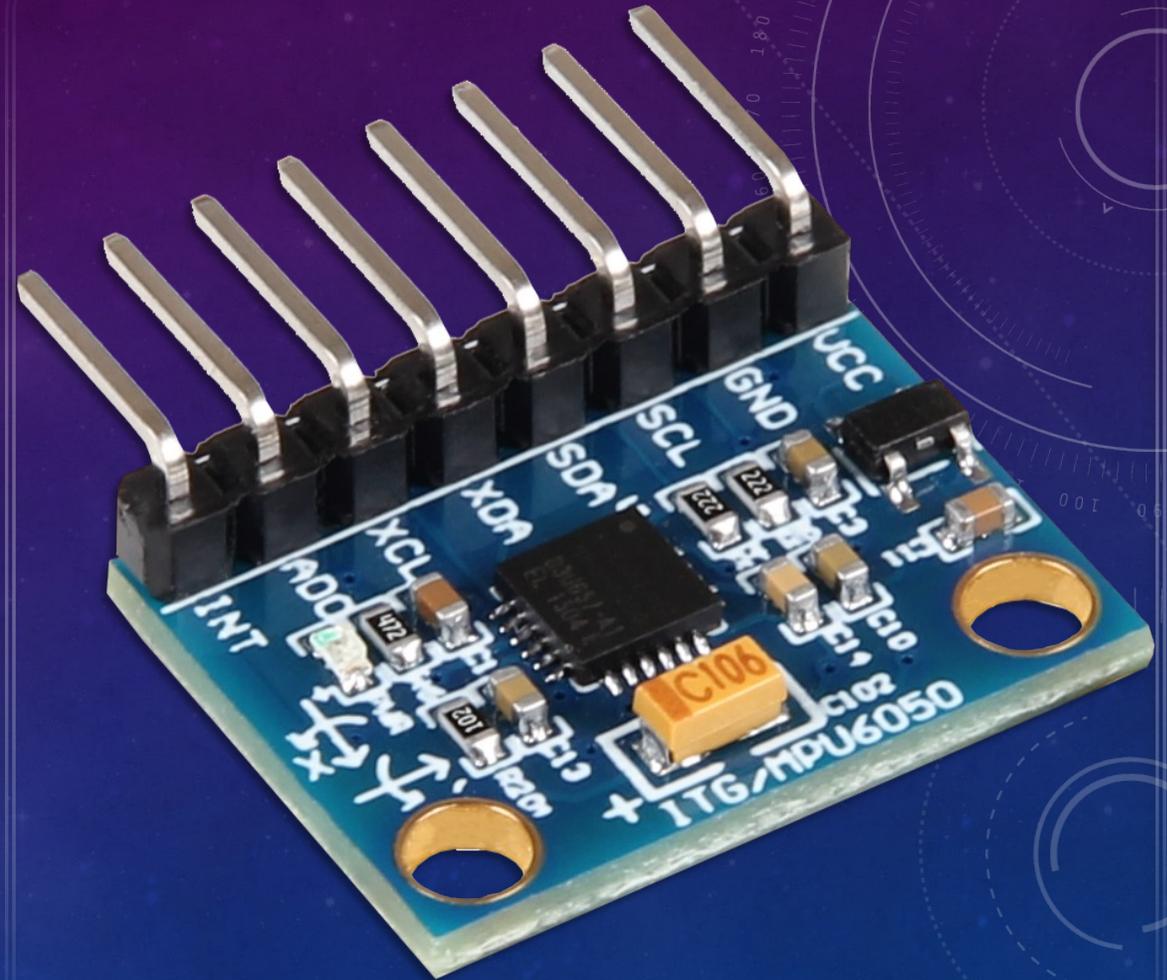
YAW, PITCH, ROLL

- Conversion from quaternion
- Desired value for rotating
- Translated to servo instruction

HARDWARE COMPONENTS

MPU6050

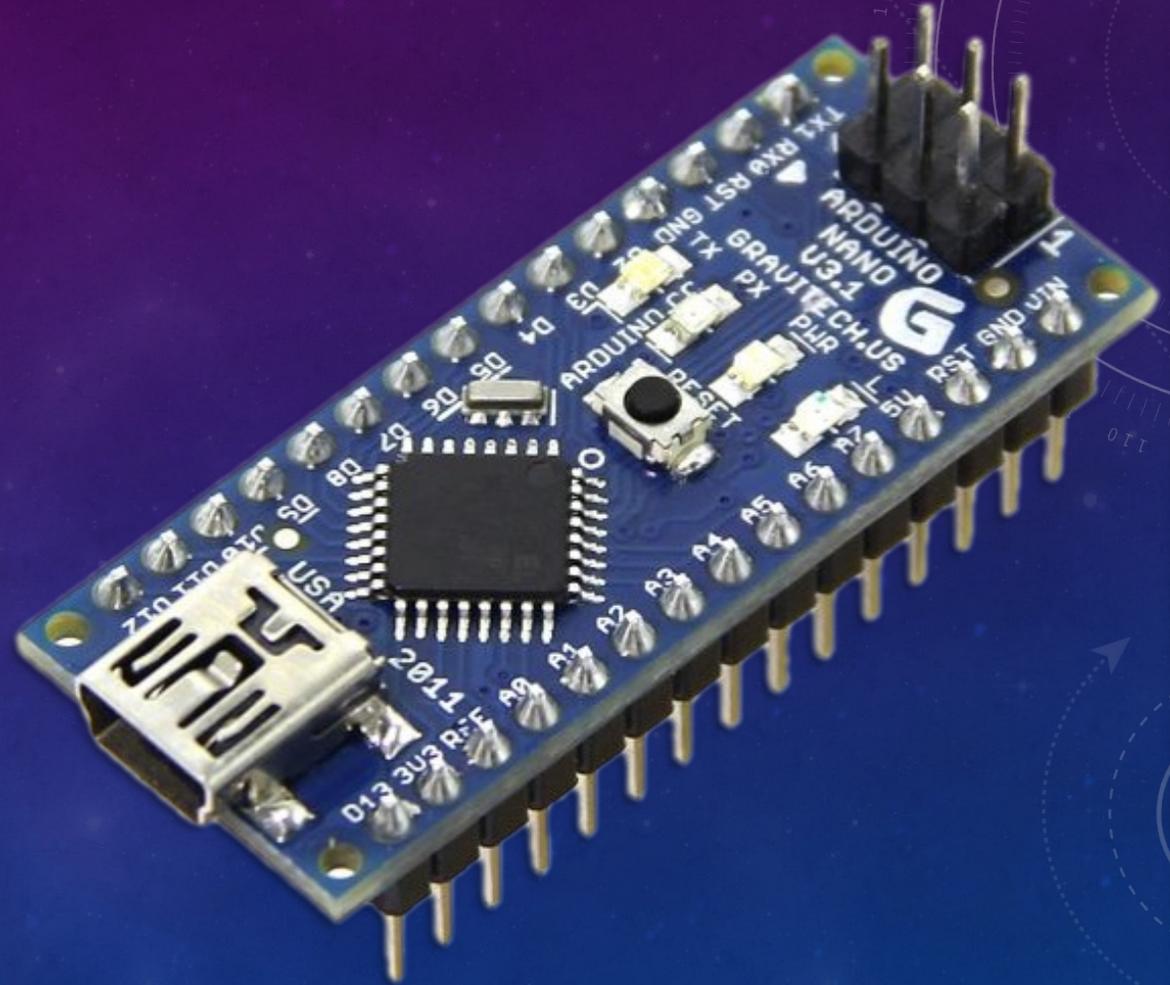
- Motion tracking sensor
- Acceleration (x, y, z)
- Orientation (x, y, z)
- Euler/Quaternion library



HARDWARE COMPONENTS

Arduino Nano

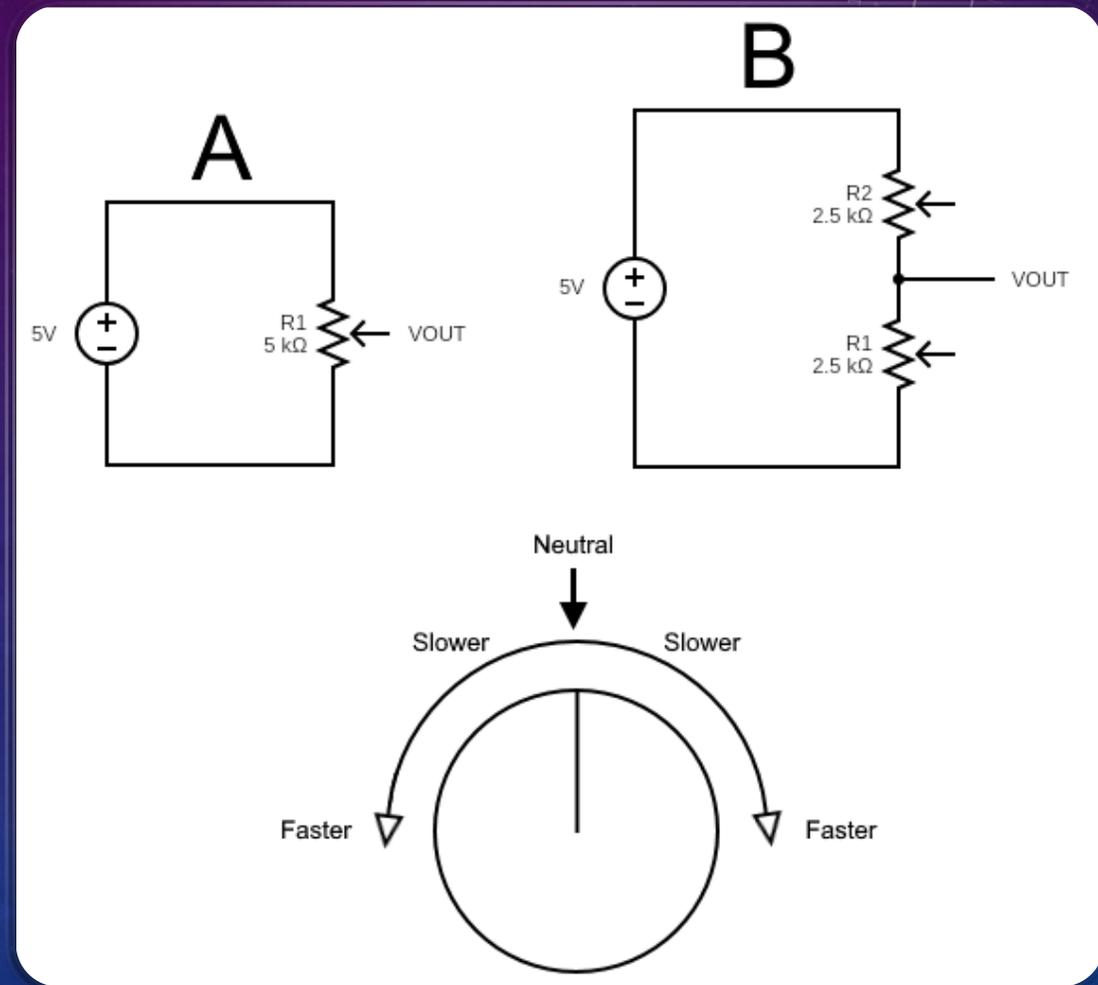
- Compact control system
- Samples motion data
- Performs calculations
- Controls servo rotation



HARDWARE COMPONENTS

Servo

- Continuous rotation
- Modified circuit
- Voltage divider
- Controls speed and direction

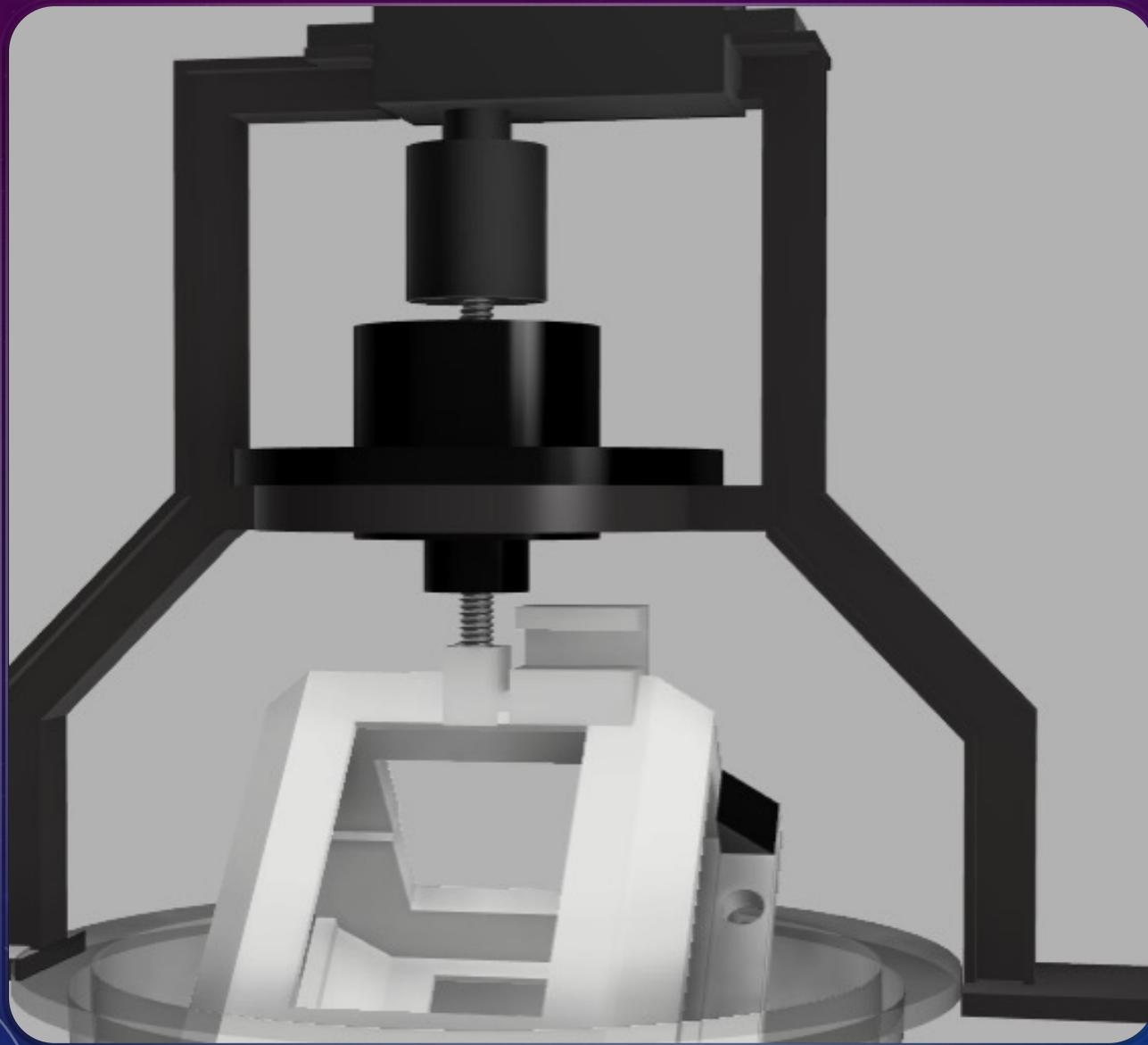


HARDWARE COMPONENTS

RunCam5

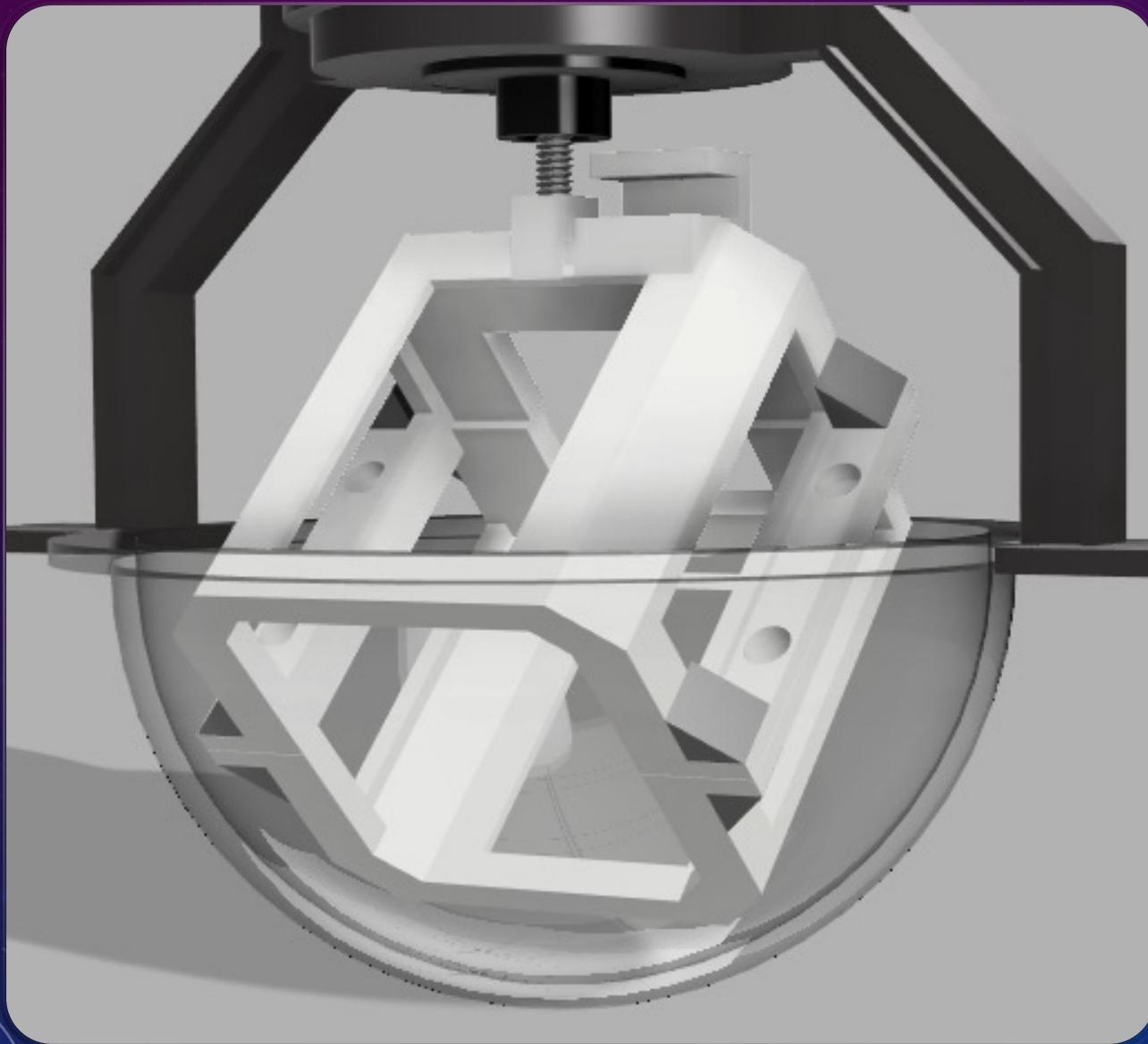
- 56 grams
- Small form factor
- UHD Video
- Touchless programming





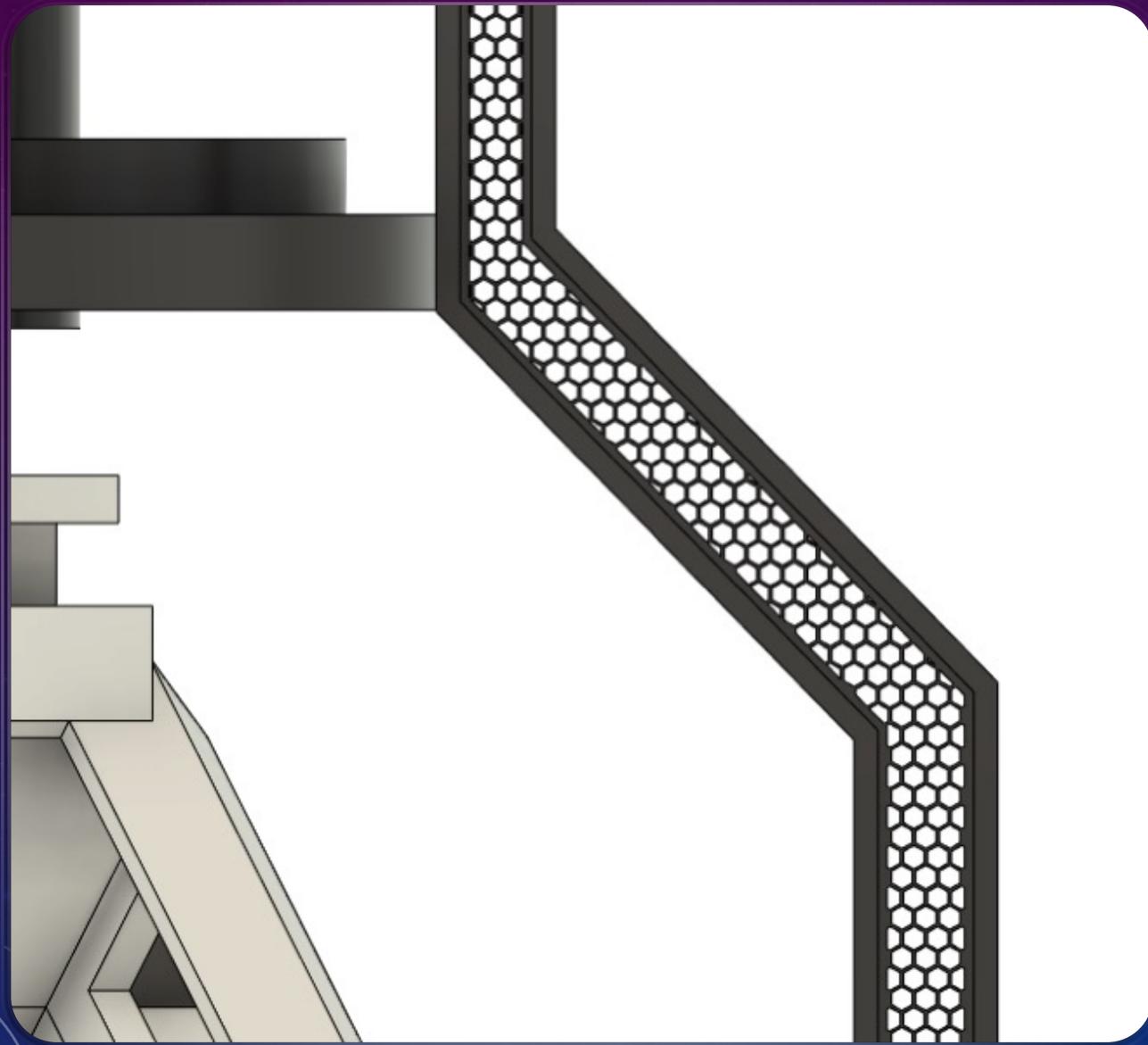
MECHANICAL COMPONENTS

- Suspension frame
- Embedded servo
- Rotating shaft extension
- Slip ring



MECHANICAL COMPONENTS

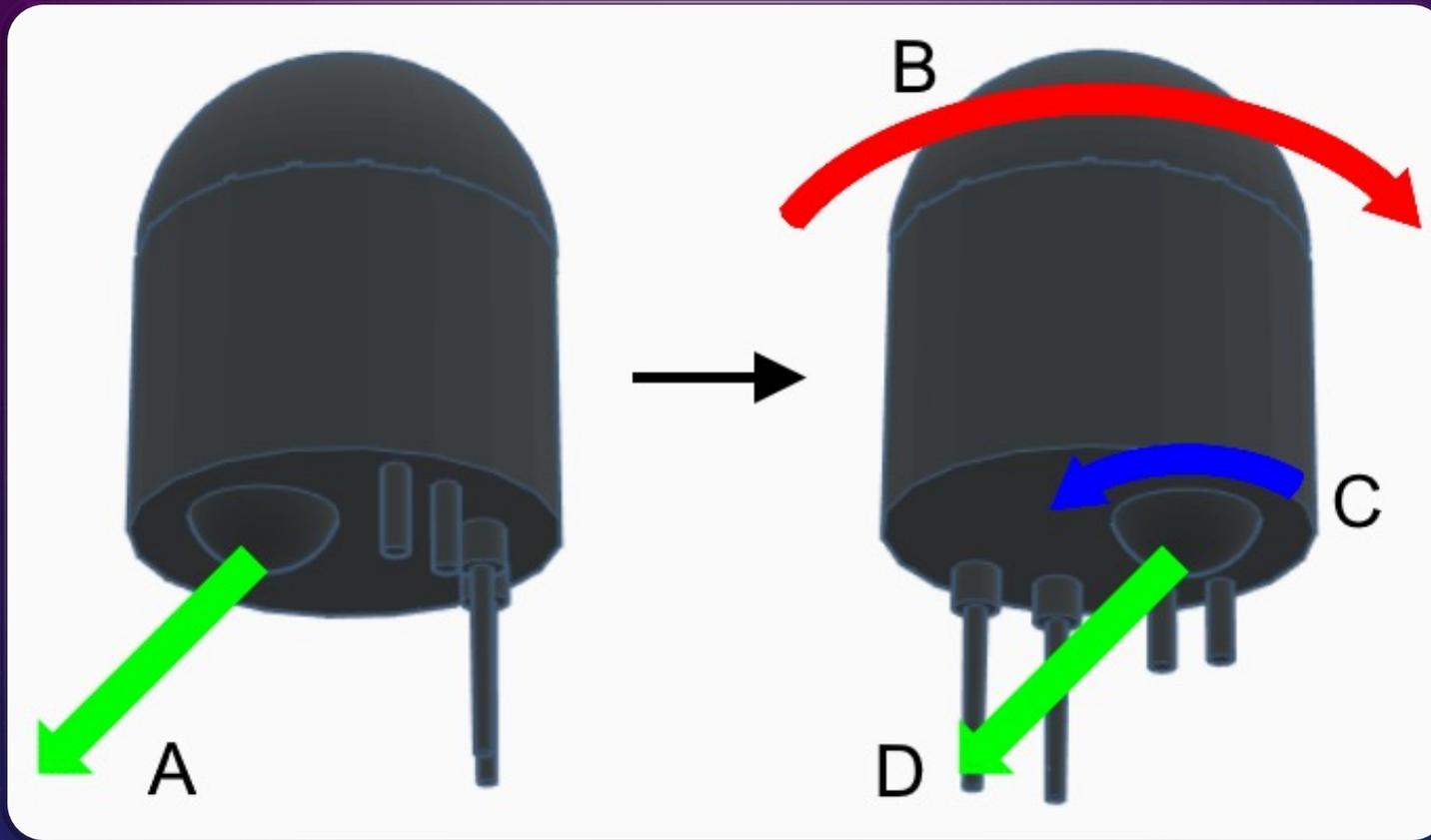
- Custom fit cradle
- Sensor mount near spindle
- Mounting points
- Clear acrylic dome



MECHANICAL COMPONENTS

- ABS Print
- Sandwich-structured
- Honeycomb lattice
- Low density with strength

PERFORMING CORRECTIONS



- A. Direction of the camera lens (default position)
- B. The controller samples acceleration and orientation data
- C. Program handles conversions, determines counter movement, executes the turn
- D. Original viewing angle is preserved, appears fixed in place

A SOLUTION TO SPINNING



RESULTS

Performance

- Servo kept pace with rotations
- Minor drift, no effect on image
- Added servos can stabilize more axes

Reception

- Promotional material for recruitment and finances
- Featured at the NASA Space Grant 30th Anniversary in Washington, D.C.
- Full video available:
<https://youtube.com/watch?v=4z79lbNbjMs>

