3D Printed Humanoid Robot
Alexandria Lehman (ME), Anthony Galgano (RBE/ECE), David Fournet (RBE), Raymond Beazley (RBE/ME), William Engdahl (RBE/ME)
Advised by: Kaveh Pahlavan (ECE) & Pradeep Radhakrishnan (ME)

Objectives
- Reproduce the functionality of the original “Poppy” project
- Reduce Overall Cost to increase accessibility
- Transition to Battery Powered
- Add modular grasping functionality
- Assisted walking

Applications
- Human Kinematic Study
- Education
- Human Robot Interaction
- Inspiration

Code Structure
- Primitive Manager
  - Ability to merge motor positions and control multiple robot behaviors simultaneously
- Robot Configuration
  - Assign motor types, locations, and groups
- Communication Protocol
  - Commands over USB
  - Arduino motor control
  - Generalized, motor type abstracted from high level code

Mechanical Design
- Major Changes
  - Motor replacement via printed adaptors
  - Shins expanded for onboard battery storage

Reducing Cost
Motors are key cost contributor
- Original: Dynamixel MX-28’s ($260)
- New: HerkuleX DRS-0201 ($130)
  - Similar torque and smaller form factor

Cost Reduction:
- Original: ~$7,000
- Final: ~$4,000

Why Resin 3D Printing?
- High Resolution
- Customized Material Properties

Koalby
Overall Components
- 25 Motors
- 62 3D printed parts
- ~1000g of Resin
- ~ 500 fasteners

Capabilities
- Nearly any Human Motion
- Untethered Functionality

Developing Motions
- Recording and replaying positions allowed for complex motions like dancing and walking.

Electrical Diagram

Key Challenges
- Complexity of self-balancing and walking
- Controlling multiple types of smart motors together
- Serial communication protocol

Future Work
- Self-Balancing and Walking
- Vision and Motion Replication
- Grasping Objects