3D Printed Humanoid Robot

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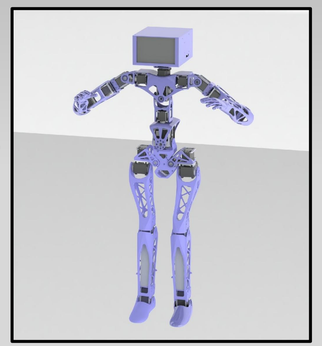
Objectives

- 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

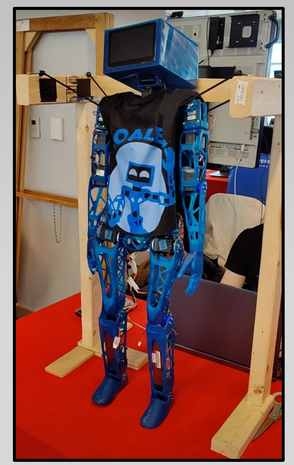
Koalby

Overall Components

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

Capabilities

- Nearly any Human Motion
- Untethered Functionality



- 1-Dof Graspable Hands designed and assembled

Code Structure

Primitive Manager

- Ability to merge motor positions and control multiple robot behaviors simultaneously

Robot Configuration

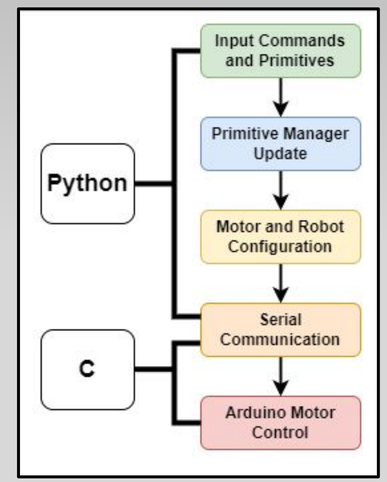
- Assign motor types, locations, and groups

Communication Protocol

- Commands over USB

Arduino motor control

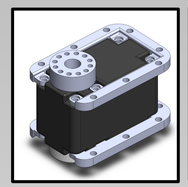
- Generalized, motor type abstracted from high level code



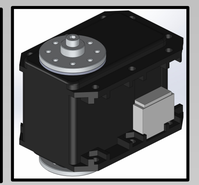
Mechanical Design

Major Changes

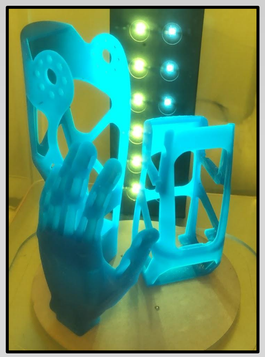
- Motor replacement via printed adaptors
- Shins expanded for onboard battery storage



DRS-0201



MX-28AT



Why Resin 3D Printing?

- High Resolution
- Customized Material Properties

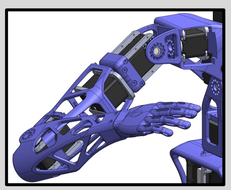
Reducing Cost

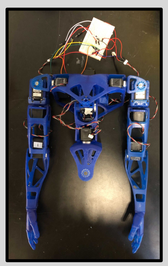
Motors are key cost contributor

- Original: Dynamixel MX-28’s ($260)
- New: HerkuleX DRS-0201 ($130)
  - Similar torque and smaller form factor

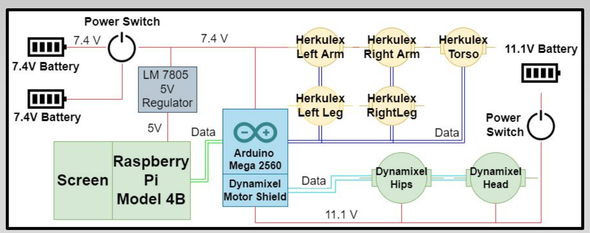
Cost Reduction:

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



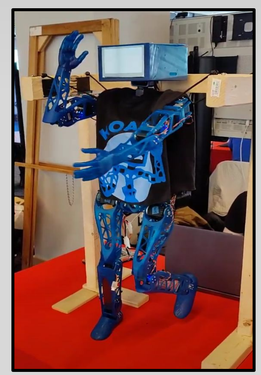


Electrical Diagram



Developing Motions

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



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