# **HuRoS**

**ABSTRACT:**

The goal for this year is to implement inverse kinematics and make the bipedal robot to walk using the gait generated from the inverse kinematics. At first, some hardware parts on the bot must be modified such that they are robust and withstand the load, and eliminate the slip present in the gears. We need to fabricate PCBs for electrical circuit and attach end contact switches for safety. Once the fabrication is completely done, we'll focus on moving the bot in forward kinematics to test the robustness of the design and make minor tweaks. After this is achieved we'll implement inverse kinematics and tune the control of the bipedal robot.

**BUDGET:**

1. Beagle bone blue - ₹7,000

<https://in.rsdelivers.com/product/beagleboardorg/bbone-blue/beagleboardorg-beaglebone-blue-mcu-development/1360693>

2. 4 High torque dc motor - ( 4 x ₹7000)

High torque dc motor - ₹28,000

<https://robokits.co.in/motors/mega-torque-planetary-gear-motor/mega-torque-planetary-encoder-dc-geared-motor-250w-100rpm-18vdc?gclid=CjwKCAjwqNnqBRATEiwAkHm2BEHONlCtzXfrA8fS6NiUTG7AofSyRTHlGmGutiIJsOei3xN_D01G3BoCFVwQAvD_BwE>

3. PCB printing

5 pieces (5 x ₹400) - ₹2,000

4. Machining + Gears

Aluminium 6082:

Part 1 - ₹1100 x 4

Part 2 - ₹1200 x 4

Gears - 1200 x 2

Total - ₹11,600

5. Miscellaneous - ₹4,000

3d printing, Limit switches

**TOTAL :**

7000 + 28000 + 2000 + 11600 + 4000 = **₹ 52,600**

## **HuRoS Till now : (2017-2019)**

**Design:**

Initial Torque Calculations at joints: Factor of safety.

Design of Ankle: Parallelogram, 4 Bar, Lead Screw mechanism (Ratio)(Lead=4\*Pitch=8mm), Linear actuators. Foot, as an adapter for future foot design.

Design of Knee: Spur gear, compound gear. 1:9 ratio.

Design of Hip: Universal Joint. Worm gear drive, Lots of iterations, possibility of lead screw, but bulky. Non intersecting considered.

Base platform: To house other components

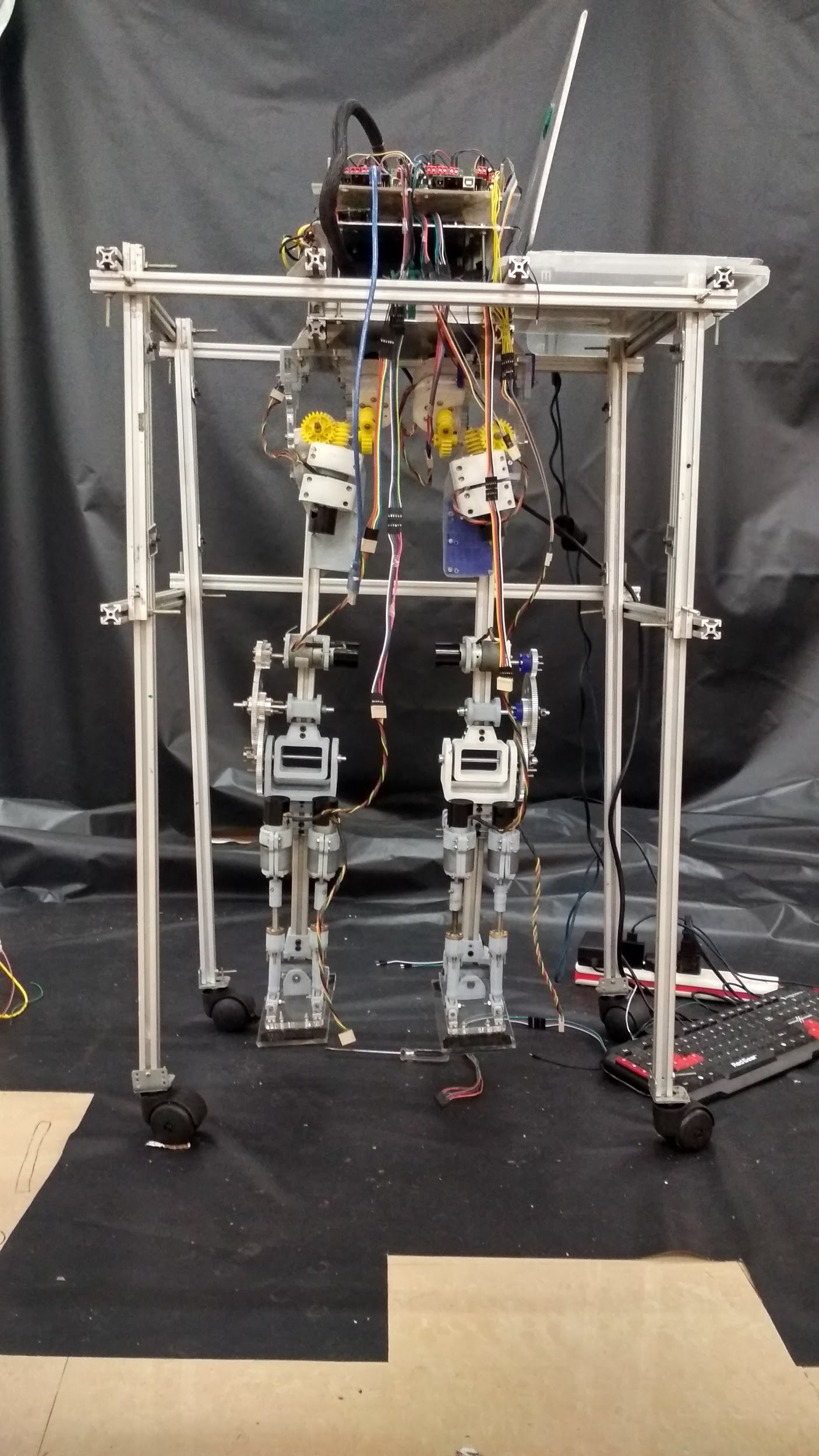
**Fabrication:**

Motor Selection: testing. Robokits. Corresponding motor mount stiffness. Pre-assembly in CAD to check fabrication. Kinematic CAD analysis. Stress Analysis, rigid body dynamics.

Prevent sharp corners, print in non shear stress direction, breakage of parts, White ABS material was better toughness, less brittle.

**Electronics:**

Arduino Mega chosen due to interrupts availability. BeagleBone(Sufficient UARTs) serves as master to 4 megas. Each Mega has position control PI tuned with ZN tuning without load. Megas have PCB mounts for easy interfacing. Each mega: 3 motors.

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