Harvestman Robot

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Abstract

The Harvestman Robot is a hexapod robotic platform designed for a variety of scientific and commercial applications. Development is currently in Phase 1, a physical prototype has been manufactured and is awaiting assembly. This phase focuses on validating the mechanical design and preparing for subsequent functional testing.

1. Project Overview

The Harvestman Robot is a six-legged robotic platform designed to autonomously navigate both rural and urban terrain. Phase 1 focuses on developing a functional prototype using closed-loop servos and a hacked-together power supply. Phase 2 will enhance the mechanical design, incorporate AI simulations for validation, and create a more dynamic mobility system. Finally, Phase 3 aims to transform the platform into a market-ready product, to ship as an educational kit or as an off-the-shelf walking platform.

2. Objectives

- Achieve autonomous mobility over diverse terrain using waypoint navigation. This will include a climbing cage.
- Develop a modular platform with standardized mounting points for engineering and research projects.
- Keep the final budget affordable for low-income households

3. Phase 1

The inspiration from the Harvestman comes from nature, where six legs are very common. The name itself is a pun, "It's not a spider" as the most common type of Harvestman is a so-called Daddy Longleg, who counter-intuitively only needs three legs to walk. The goal of Phase 1 is to build an initial testing base where I can try several algorithms and approaches. This being said, Phase 1 is controlled by a "pass point" system where I can give each leg a waypoint and it will add it to a queue and interpolate between each point on the queue.

4. Phase 2

Phase 2 is currently in the planning stage and will begin after completion of Phase 1 assembly and initial testing. The primary goals are:

- Conduct mobility simulations in Isaac Sim to analyze stride patterns and mechanical limitations. Further study needs to be done in a roll axis in each shoulder.
- Design an integrated motherboard for power distribution and data management.
- Incorporate multiple camera inputs to enable computer vision algorithms.
- Refine the mechanical design based on lessons learned from Phase 1.
- Implement a battery management system (BMS) to ensure safe power delivery and charging across modular components.

5. Phase 3

Phase 3 is the ideals section. I hope to use the Harvestman as an educational tool for middle and high school students to learn about robotics in communities where robotics education is not yet feasible.
I also hope to use the Harvestman to bring robotics to meticulous jobs in various industries. Having a strong connection to agricultural communities, I believe the Harvestman will be complete when it can effectively harvest garden crops autonomously and navigate sufficiently to "send and forget" between waypoints.

6. Next Steps

The Harvestman Phase 1 is manufactured and ready to assemble, and its algorithm is already programmed and ready to go using bluetooth to drive it in any direction.
Phase 2 will happen once I have Phase 1 assembled where I will setup an IsaacSim environment on my home PC. I also intend to find a mechanical and electrical engineer to improve the design for this phase.
Phase 3 will begin once Phase 2 has reached the goals of safely navigating difficult terrain, and will be implementing various missions and tasks.

7. Figures / Diagrams

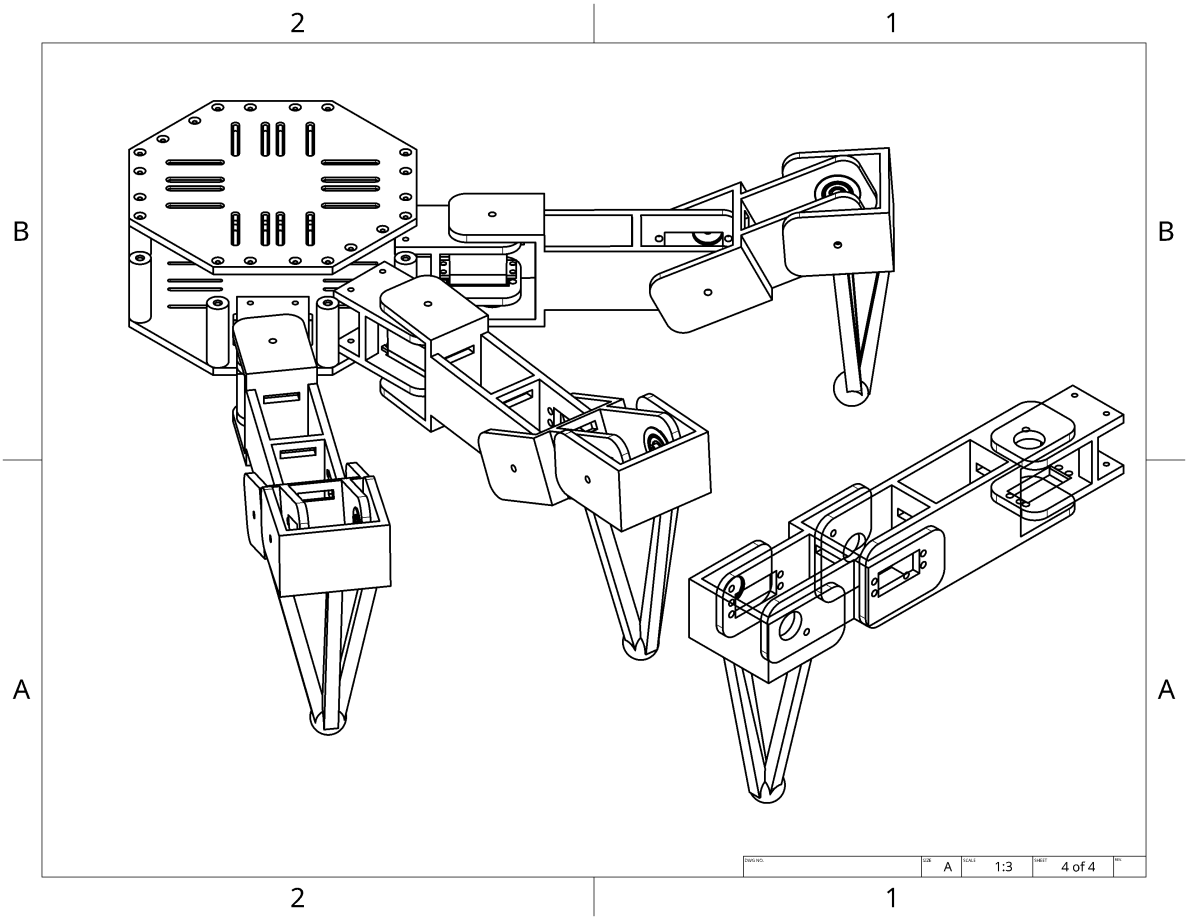

Figure 1: Phase 1 Harvestman, real model includes 6 legs

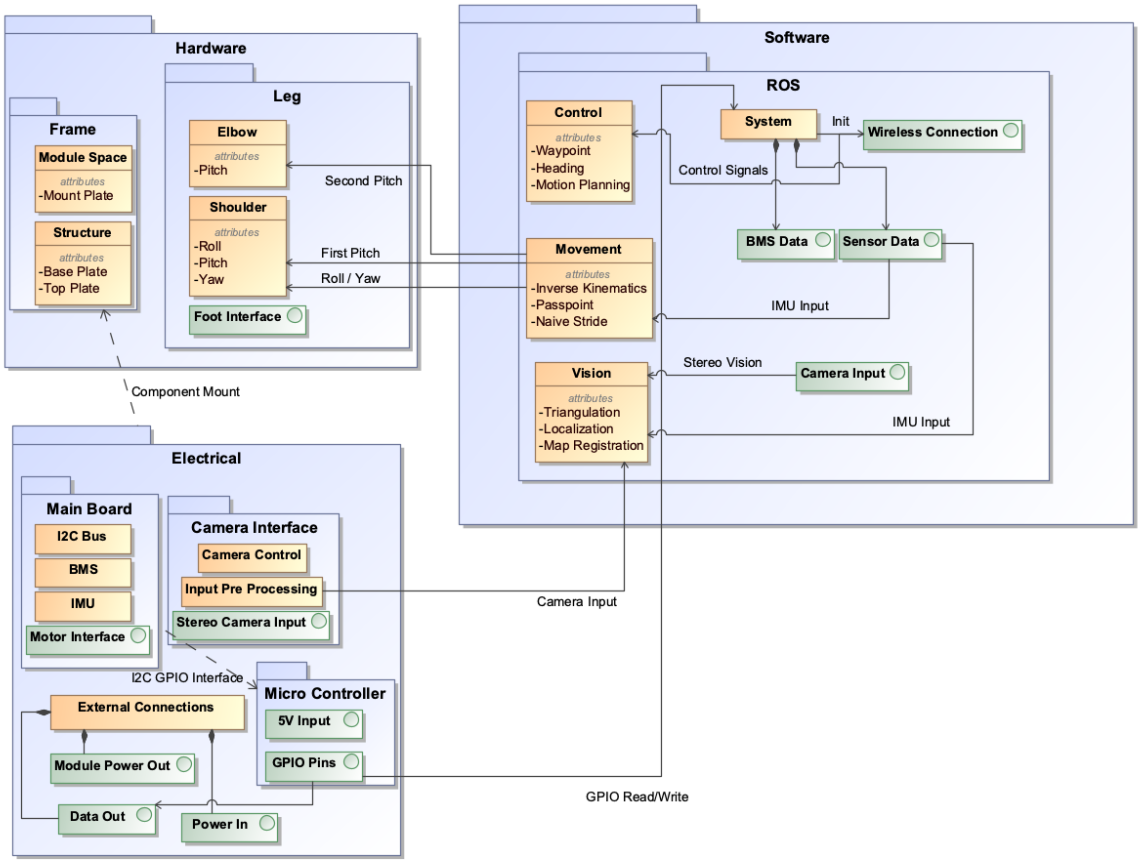

Figure 2: System Diagram. Approximate.