

6-Axis Mobile Construction 3-D Printer

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Special thanks to everyone who supported and helped us

Abstract

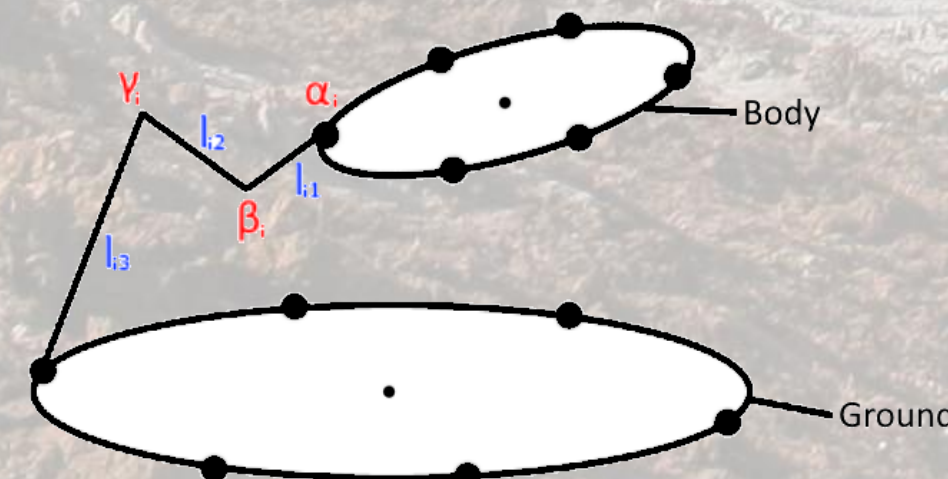
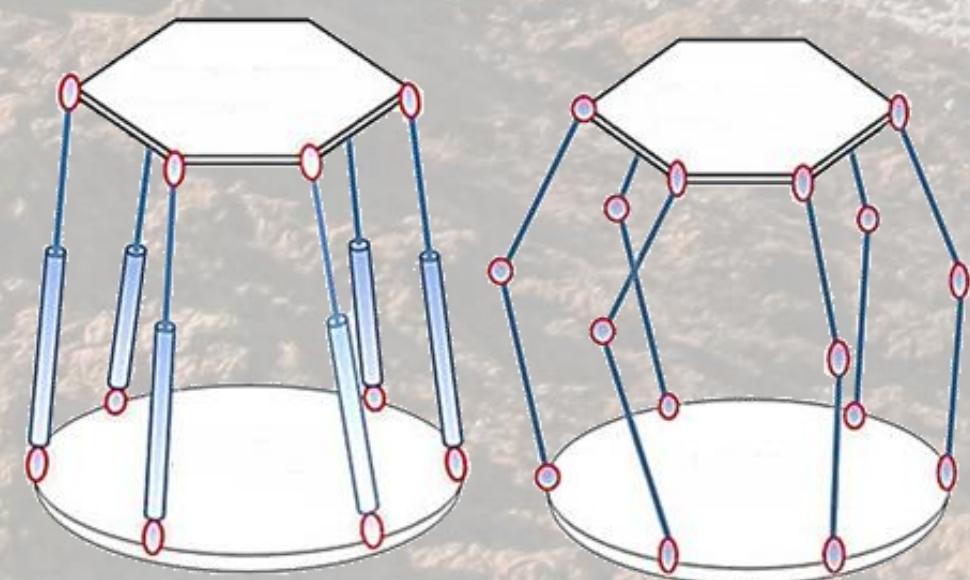
This project explores the development of the PRIMO (mobile printer) - a 6-axis 3D printing construction robot - with the potential to revolutionize the construction industry by enabling printing in remote locations. This six-legged (hexapod) robot can walk, and its main body has six degrees of freedom, facilitating nonplanar printing on an almost limitless print bed size. In addition, the robot is equipped with a custom concrete extruder and brick placement mechanism, enabling the printing of entire structures with minimal human intervention, one after another.

Objective

The goal for PRIMO is to be able to print a basic structure. This includes the ability to walk, gyrate, print concrete, and even lay bricks on the concrete.

Gyration

- The ability to move to any position within its range of motion in 6 degrees of freedom (x, y, z, pitch, roll, yaw) using the simultaneous motion of all 18 joints
- Parallel robot with rotational joints over prismatic



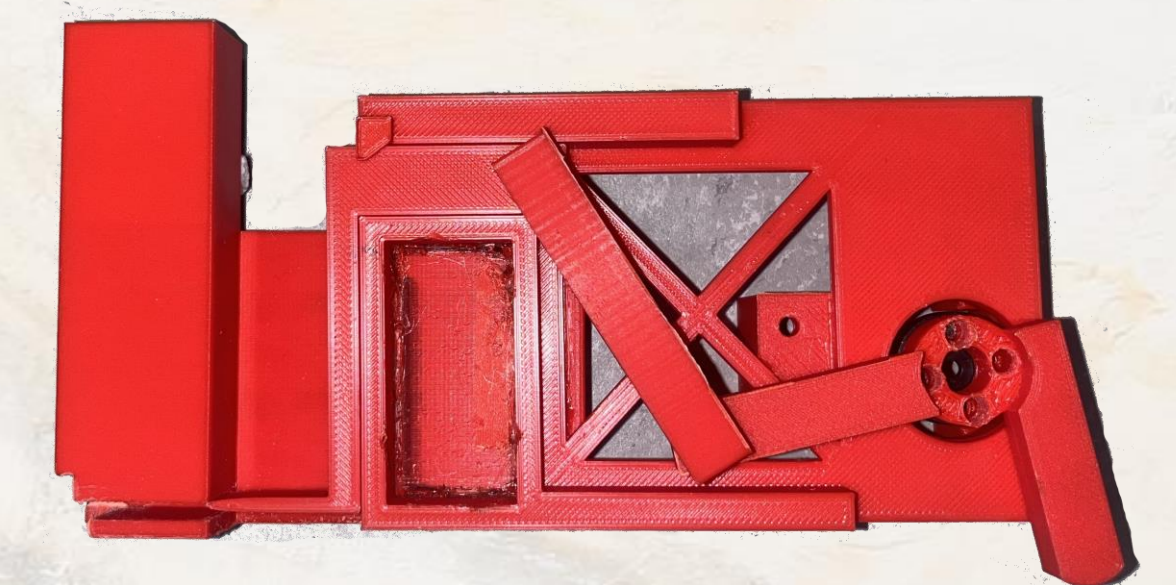
Concrete Extrusion

- Utilizes swirler design to extrude concrete mixture from main tank
- Using gyration, concrete can be printed in an FDM printer style
- Concrete needs to be properly agitated in the tank for consistent print quality



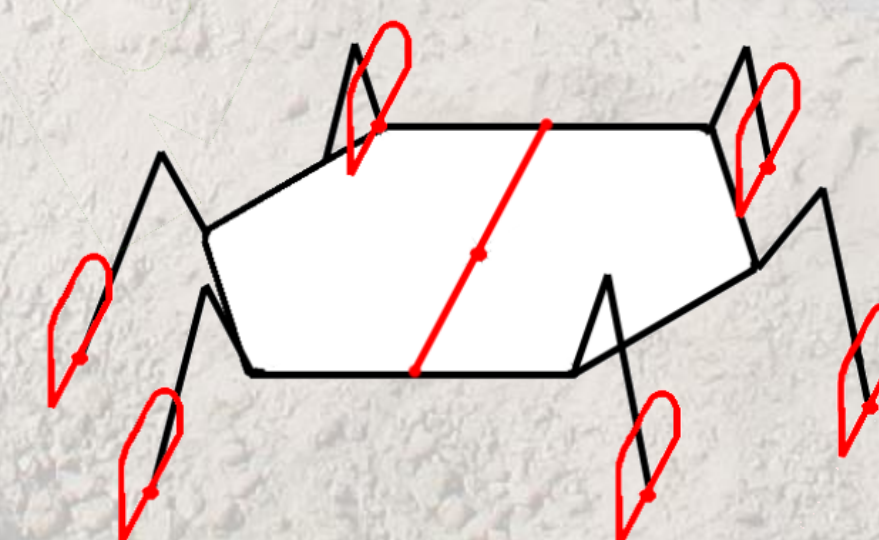
Brick Placing

- Places model brick the size of PEZ candies
- Bricks need to be pushed into the concrete for better adhesion
- Utilizes pusher style design that can push bricks out and down using one motor input



Walking

- Uses similar algorithm to gyration, but with moving instead of fixed endpoints
- Leg end effector trajectories are generated for different directions at various speeds
- Wave gait is used most often as it allows for the most consistent velocity



L1									
L2									
L3									
R1									
R2									
R3									

Wave Gait

