



A SYSTEM AND METHOD FOR 3D PRINTING BUILDING STRUCTURES

IITM Technology Available for Licensing

Problem Statement

- 3D or 3-dimensional printing, is a method of creating a three-dimensional object layer-by-layer using a computer-created design.
- Concrete 3D printing** has gained lot of attention because of its **potential for fast construction**. However, one practical issue is that printing large scale structures require a gantry system that is bigger than the structure itself. One method of solving this problem is to make the printer mobile, that is, making the gantry system move on wheels and rails.
- However, **vertical movement of the gantry is still a challenge**. Therefore, the height of the printed object is limited by the distance by which the system is able to move in the vertical direction.
- This invention solves the above problem by introducing a **new type of automated lifting mechanism** for the gantry. The mechanism permits increasing the vertical movement capability indefinitely.

Technology Category/ Market

Construction, 3D printing, Computer aided design

Applications - Construction, Structural Engineering, Concrete 3D printing.

Market - The global 3D printing construction market size is **USD 3.42 billion in 2022** at grow at a **CAGR of 65.25%** from 2023 to 2032 and reach USD 519.49 billion by 2032.

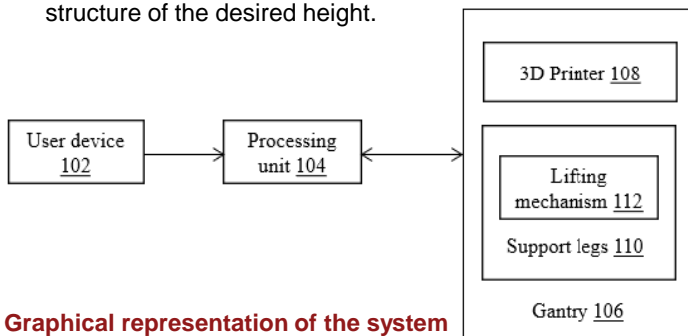
Technology

- In the proposed invention, the printer head is moved on a gantry system similar to standard 3D printers. The printer head moves on a **rack-and-pinion or similar arrangement that is supported on a horizontal frame as shown in Fig.1**.
- Beams move on the horizontal gantry frame in the x and y direction and thus permits the printer head to the positioned according to the required x,y coordinates.
- Unlike conventional gantry system, this invention **uses a lifting arrangement to move the horizontal gantry frame** in the vertical direction. The lifting system supports the horizontal gantry frame at eight points, L1-L8, with two supports at each corner (Fig.1). Each support consists of a **column and a lifting base as shown in Fig. 2**.
- The length of the column changes as the printing progresses. Initially, a set of short column segments support the horizontal gantry frame, with the lifting base supporting the column segments.

- When the height of the printed object reaches the limit of the current height of the gantry, **the gantry height is increased through the lifting arrangement**.

System

- The system comprising: a processing unit (104) configured to receive and transmit a user input 5 from a user device (102) to a 3D printer (108) configured to 3D print the building structure to a desired height, based on the received user input.
- The system comprises at least one **gantry (106) comprising: one lifting mechanism (Fig. 3), one motor and a plurality of support legs (110)** comprising a base and at least one existing column segment. The lifting mechanism (112) raises at least one support leg (110), to enable the motor to automatically attach at least one new column segment to the existing column segment.
- Thus, one gantry beam (106/1-4) is lifted upwards. Further, all remaining gantry beams (106/1-4) are lifted upwards to enable the 3D printer (108) to print a building structure of the desired height.



Graphical representation of the system

Intellectual Property

- IITM IDF Ref. 2370
- IN 429253 - Patent Granted

Key Features / Value Proposition

- Unlimited size** of the printed object.
- Cost-effective fabrication** of the printer.
- Ability to easily transport** and assemble the printer on site, without having to handle heavy parts.

TRL (Technology Readiness Level)

TRL - 4, Technology validated in lab.

Research Lab

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Images

Fig. 1. Gantry supported at eight points

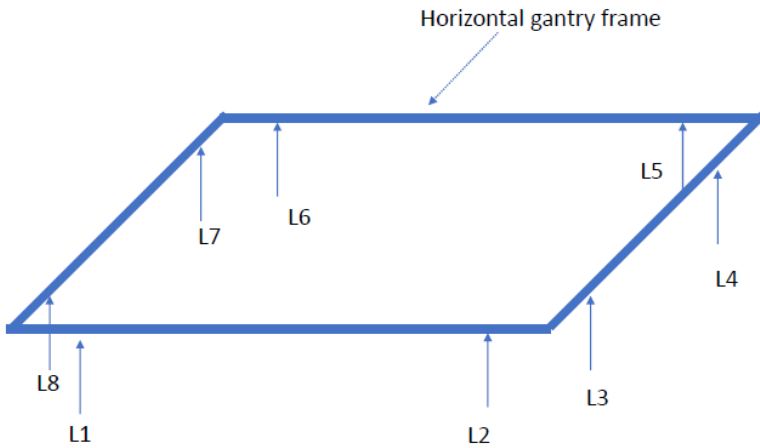
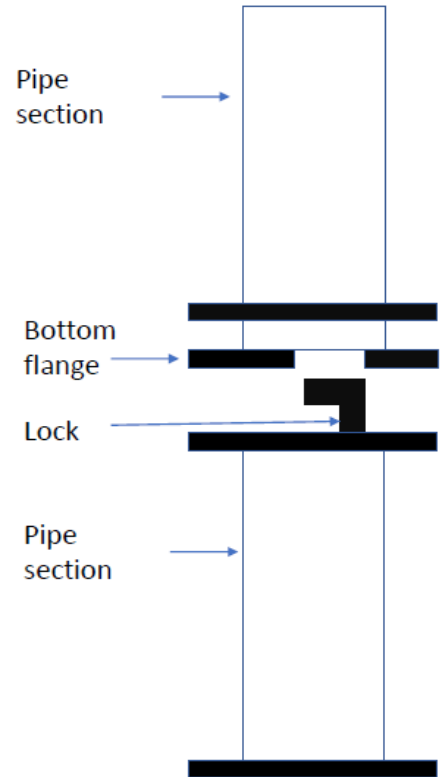


Fig. 2. Automated connection of column segments



Side view showing two column segments

Fig. 3. A lifting mechanism using lead screw and motor

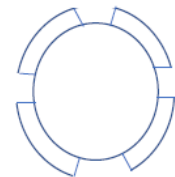


Lead screw

Lifting base

Servo Motor

Gears



Plan view of bottom flange of column segment

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