DESIGN AND FABRICATION OF AN ARTICULATED 3D PRINTER

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Introduction:
Additive manufacturing technology is used to create prototype designs for traditional manufacturing as well as research purposes. 3D printing allows ideas to be visualized and developed faster than ever before. The technology shrinks the development process time, helping companies stay one step ahead of the competition. Most of the 3D printers available nowadays are desktop / Cartesian type which consumes more floor space and provides less work volume and also this type of machines are meant only for single operation. To overcome these constraints an articulated robot arm is proposed that can be used for 3D printing in order to give more work volume and utilizing lesser floor space. The use of articulated robot arm can be utilized not only for this 3D printing operation, but it can also perform other operations like, pick and place, pen plotting, laser engraving etc. by changing the end effectors suitably.

The prototype of the robotic arm was choosing an appropriate configuration and degrees of freedom (DOF) by studying the weight of the end effector (3D printer). The actuator was controlled using an open source microcontroller which was programmed to carry out the various operation using robot arm.

Objectives:
The objective of this project is to design and fabricate a low-cost 3D printing device using an articulated robot arm for 3D printing application which will increase the work volume and reduce the space consumption of machine.

Methodology:
- The constraint of an existing gantry type 3D printer was analyzed and the design concept was arrived to overcome these constraints.
- Fused deposition method of 3D printing was chosen as it was less expensive than other existing processes.
- The X, Y and Z axis movements were arrived at, considering various factors such as end usage, cost of fabrication, simplicity of design, synchronization, accuracy etc.
- The concept of the robot arm was finalized using solid modeling by solid works software. The material selected for the structure of robot arm was chosen as Aluminum6061, and the links of the robot arm was fabricated by lasercutting machine.
- The assembly of various components was carried out prior to the integration of the electronics components. Arduino micro controller was used along with NEMA 17 stepper motors for the actuation of robot arm assembly.

Results and Conclusion:
The objective of the project was to design and fabricate an articulated 3d printer that is low cost and be available in the market. The mechanical structure was made by using aluminum 6061 sheets, stepper motors for the control of individual axis. Arduino mega 2560 microcontroller was used to control the motors and other electrical and electronic components various geometric shapes were printed and the output of the project was studied for its geometric accuracy and feasibilities. The first level of prototype was successfully demonstrated.

**Future Work :**

The accuracy and surface integrity of the components made by this project can be increased by enhancing the structural rigidity of the device and by upgrading some of the electronics components

**Usage:**

By attaching different end effectors, various other operations can be performed such as, pick and place, laser engraving, 3D CMM, Image recognition and 3D scanning.