Institute Technical Summer Project (The Matrix)

Shape Copying Bot

A bot which can change its shape according to the input given to it.

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Basic structure-The bot can copy any shape according to the input provided to it.

Our plan for the design

1. Our bot will have a basic cuboidal framework which will have small cuboids below the top surface which can move up or down because of the mechanism inside (will look like a chessboard in the top view).
2. These cuboids will be supported by slots made so that the cuboids have upward or downward movement only.
3. The rise of the blocks will be controlled by the actuator to provide variable heights to the blocks so that it looks like a real 3D structure.
4. We will be use ball and screw mechanism to raise the blocks to the desired heights. The pitch of the motor in this mechanism is fixed, hence, by varying the number of rotations we can raise the blocks to the desired heights. The complete process of raising the blocks will take some time (maybe around 2-3 minutes) but, it will be much more feasible than using an actuator for each block.
5. The cuboidal blocks will rise according to the input given to it. Each block will be raised to a specified height which will then make the surface like a 3D shape of the input.
6. The framework will be a mesh design (may be 3D printed) into which cuboids will be put; with rubber at its sides (to hold) to allow the cuboids to hold their position after they are raised up.
7. This will be controlled by an arduino attached to this mechanism which will be coded according to different inputs given.
8. In this system some major applications are –
    a) We can form some 3D graphs like plotting graphs z=x*y. For this each block will be specified by a x,y-coordinate, thus after appropriate input the blocks will rise such that in the end it will look like the 3D plot of that graph.
    b) Or we can also design a 3D shape by inputting the front, side and top view of that solid.

Our plan for implementation –

Week 1-2 -> Will learn the basic softwares like openCV, Microsoft visual C++, solidworks, microcontroller coding, matlab etc. and get all the basic equipments ready or work and design our bot in solidworks.

Week 3-4 -> We will start working on the mechanical part of our bot according to the decided design and we will make a small design to check our design. Also 2 members will work on the coding part.

Week 5 - After the small part works out we will fix the design and start upon working the electrical circuit of the bot.

Week 6 - We will work on how to input our image to it and try to complete it by the end of the week.

Week 7 – By this week we will complete the task and may be work on adding some extra features (if time permits) like pressure sensitivity (it will take the shape by sensing the amount of pressure applied e.g. if suppose we apply pressure on the chessboard shaped framework with our hand it will take the shape of our hand which can done with the help of piezo sensors.)

Equipments required

- Microcontroller ~ Rs. 700
- Small cubical blocks of dimension ~ 1cm.
- Sliders
- Stepper/servo motor ~ Rs. 1400
- Piezo sensors ~ Rs. 1800 each (Optional- depending on the time)
- Grid (for the basic framework) - Preferably 3D printed.
- 2 motors to drive the stepper motor on sliders to every cube ~ Rs. 200 each

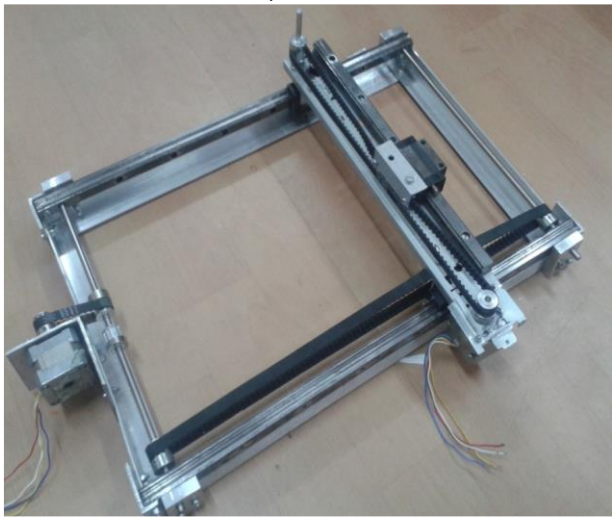
NOTE-

We have tried to write the mechanism for raising the blocks in the steps above.

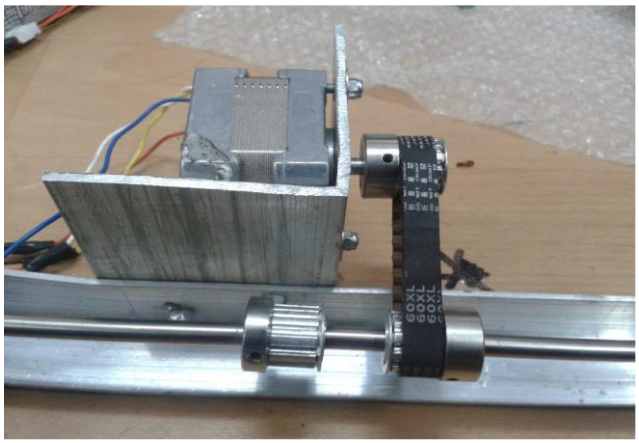
We will try to complete the software learning part by the first week and also start the basic mechanical design.

Also, it does not look like we need to scale down the project too much.

We can successfully implement the slider mechanism, so no need to put servo motors for each block (which in turn looks non-feasible).



->The slider mechanism on which will take the Actuator to the desired coordinates.



->The stepper motor used to drive the horizontal rail on the 2 vertical rails.

TEAM MEMBERS:

Abhinav Anand Mishra (130100044)

Kumud Acharya (130100032)

Atishaya Jain (130100054)

Ujjwal Anand (130100059)