

Rubik's Cube Solving Robot

Introduction

This bot is capable of solving a 3x3x3 scrambled Rubik's cube on its own. We have created a nice user interface for the user to enter the scrambled Rubik's cube. On entering all the faces, an optimal set of moves is sent to the bot which when executed solve the Rubik's cube.. This bot is capable of solving any cube with an average time of 2.5 seconds.

Technical Aspects

- The bot uses six stepper motors each with a claw fixed to its shaft that goes into holes drilled in each face of the cube. Thus by rotating each motor we can rotate the corresponding face of the cube.
- The algorithm used to solve the cube as entered by the user is Kociemba's algorithm, developed by Herbert Kociemba in 1992. It is capable of solving any cube in less than 30 moves.
- The correct set of moves when computed by the computer is then sent to an Arduino board using serial communication. The Arduino board further controls the motors to solve the cube.

Theory Involved

- We have used A4988 stepper motor drivers to control each motor along with an Arduino Mega 2560 board. The arduino is powered by 12V batteries and the computer. The following website was used to learn how to control stepper motors:

<http://howtomechatronics.com/tutorials/arduino/how-to-control-stepper-motor-with-a4988-driver-and-arduino/>

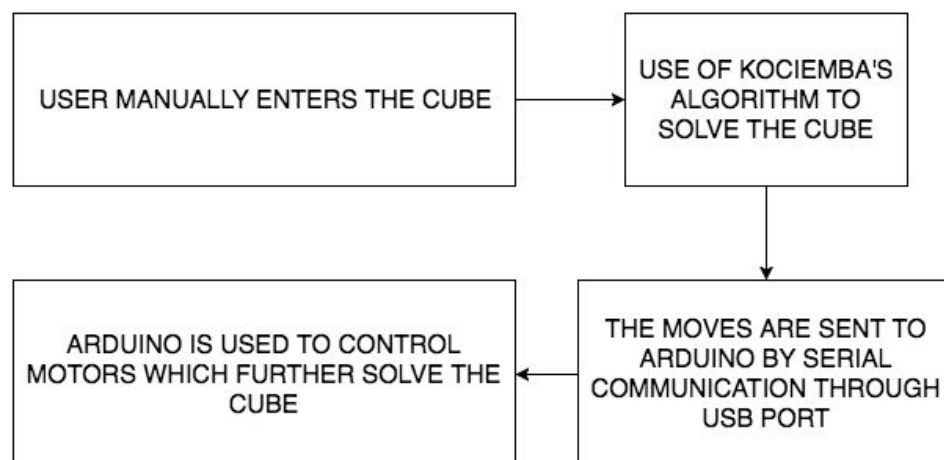
- Serial communication has been used to communicate between the Arduino board and the computer. PySerial, a python library has been used. Refer to:

<https://www.arduino.cc/en/Reference/Serial>
<http://pythonhosted.org/pyserial/>

- A python implementation of Kociemba's algorithm has been used to solve the cube. Refer to:

<https://github.com/muodov/kociemba>

- The Tkinter library in python has been used to create a graphic interface to enter the moves manually.



Github Link to Project:

<https://github.com/kunalmittal/cube-solver>

Watch Our Bot Solve The Cube:

<https://youtu.be/CJKFAN1Jk-E>

Major Components Used:

- Bombay Electronics at Lamington Road
 - Stepper Motors of torque 750g-cm (x6) - Rs 900 (Could not be used because of less torque)
 - A4988 Stepper Motor Drivers (x6) - Rs 1200 (3 of these were not working properly)
 - Arduino Mega 2560 (x1) - Rs. 850
- Amazon
 - Dayan Zhanchi 3x3x3 57mm Rubik's Cube with lubricant (x1) - Rs 800
 - Techno Tech ZB V90 Webcams (x4) - Rs 1116
- Mangaldeep
 - Stepper motors of torque 1.6kg-cm (x6) - Rs 2700
 - A4988 Stepper Motor Drivers (x3) - Rs 600
 - 12v Battery (x2) - Rs 800

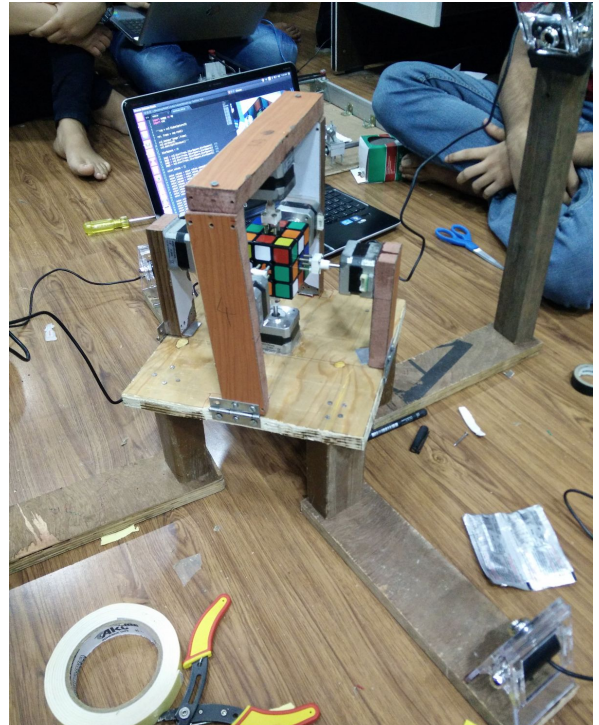
Miscellaneous components like wood, wires, screws, etc. from various shops outside Main Gate - Rs 1000

Total Cost - Rs 10,000

Project in The Making:



Completed Project:



Our PCB:



Our Team Members:

- Kunal Mittal
- Sudhanshu Singh
- Ashish Soni
- Anshik Gupta