SELF TRANSFORMING ROBOT

Self transforming robot is a bot which changes or “transforms” shape according to the hindrance occurring in the way where the robot is being moved. Self transforming robot contains the combined motoric structure which is chosen to accomplish the flexible transformation on varied terrains.

TECHNICAL ASPECTS OF THE PROJECT

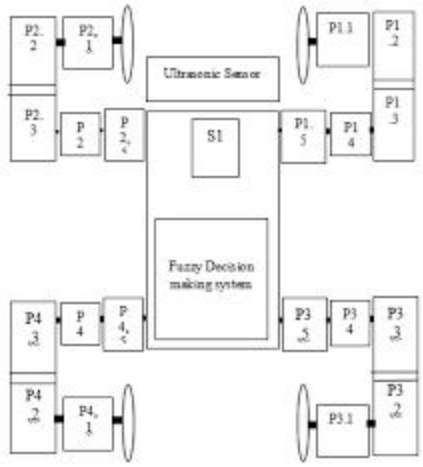
The main points to be focused upon-
1.In the mechanical part there we used thr concept of revolutionary project to keep the motors stable and yet rotating.
2.Also in our project only one servo motor rotates at one time (either motor or either clamp).
3.Each motor rotates the backward part of the remaining part of the leg in which it is attached to.
4.The motors are rotated by servo.attach(); function writing, compiling and uploading on the arduino board.
5.we have used two arduino boards which are connected to each other by UART serial communication.

THEORETICAL ASPECTS OF THE PROJECT.

1.Design Concept

1.A. Robot Model

Planning for mobile platform so as to keep the bot compact was done. Combined servo motor structure provides produces less weight and provides high initial torque with low power. The idea behind the robot design depends on the drive configuration. And according to the proposed drive configuration the system will adapt the movements to provide the modular activities in correspond to the surroundings. We gave it a thought that reduced number of motors will decrease the weight as well as the motors will have higher efficiency. But increased number of motors includes more reliable transformation, in other words, we can perform flexible multiple operations in a single module.
The design will exhibit two work state- the linear state and parallel state.
The linear state will enable the robot can go through narrow passage.



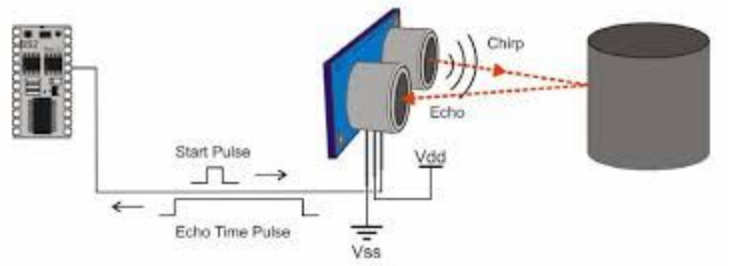
(The schematic in linear state. // image taken from google)

The parallel state enables the robot with high mobility on rough ground.

(//taken from google)

1.B. Sensor configuration

An ultrasonic sensor is used to access the environmental information.Overall sensing ability is fixed as 180 degrees with 10 angular motions in each rotations.



(Here, the arduino is kept on the mobile platform of the robot.
//image is taken from google)

1.C. Arduino Configuration

We used Arduino Mega 2560.

The Mega 2560 is a microcontroller based on AtMega 2560.It has 54 digital I/O pins (out of

which 15 are PWM outputs), 16 analog inputs,4 UARTs. Since we are using 17 servo motors we need to use 2 arduino boards.

(https://www.arduino.cc/en/Main/ArduinoBoardMega2560)

2. Practical Application

The design was thought like- Each arm will have 4 servo motors plus one dc motor which will be supported by suitable clamps designed by us. For the selection of servo motors we calculated the maximum torque in the straight position in linear state which came out to be about 12 kg/cm. Hence we ordered our motors accordingly.
The ultrasonic sensor was put in the forwarded part of the bot so that it can sense the obstacle. And the arduinos are used to control the servo motors as well as the ultrasonic sensor.
The codes in arduino are written by performing multiple iterations of each and every servo motors do bring it upon the final positions.

Reference Links

This Autonomous **Self**-Reconfigurable Locomotive **Robot** was previously made by M.Hussan Shariq for BEng Mechanical Engineering Honours project in year 2009-2010 @ Heriot-Watt University,Dubai Campus. Inspired by his work we are also working to make a mini replica of that awesome project.
https://www.youtube.com/watch?v=6tD3dsDzbeg

Theory
https://lookaside.fbsbx.com/file/jeas_0415_1848.pdf?token=AWyrwb2UT7w0hvFJuZPY8lwXbPfcmzXeGY5CtEoGzQqkkfu8rDYNEbI92jrkKhS7A5lVkbgdXNcU4M8tclfrdAjx68pyB4p1dYOJIbFF6bTOtG1q2e3MJOEy4WvRS3m0ITyg1h7G9x2_oCWU0tGg7G_DHbj_Z4Yn_5TgCax3tmCjWQ

Working Principle of Servo Motors
https://www.youtube.com/watch?v=-XSXfqd1N58
https://www.youtube.com/watch?v=v2jpnyKPH64

Purchase of our servo motors
Calculated the maximum torque required taking into account the straight and bent position and it came around to be 12 kg/cm(approx) so we order 1501MG servo motors from Turnigy which sufficed our requirement.
http://www.hobbyking.com/hobbyking/store/__9617__Turnigy_8482_TGY_1501MG_MG_Servo_15_5kg_0_16sec_60g.html

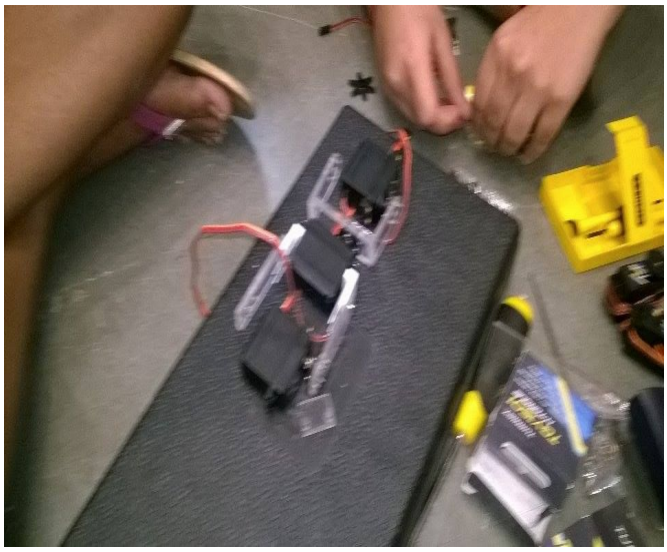
This is the datasheet of our motor. We referred to it mainly for dimensions so that we can build our clamp accordingly.
https://www.pololu.com/file/download/HD-1501MG.pdf?file_id=0J729

DATASHEET
http://www.robotshop.com/media/files/PDF/ArduinoMega2560Datasheet.pdf

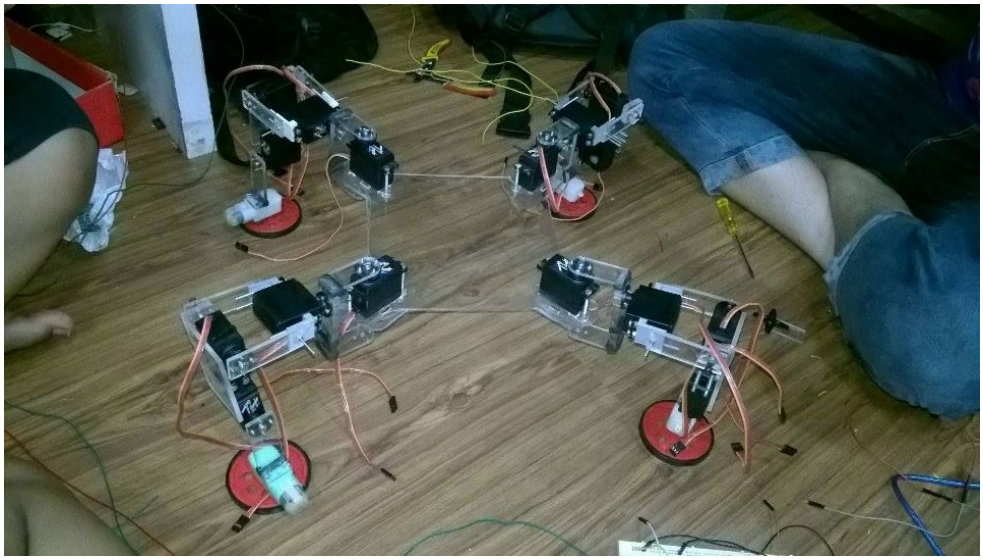
http://www.atmel.com/images/atmel-2549-8-bit-avr-microcontroller-atmega640-1280-1281-2560-2561_datasheet.pdf

Learning to code arduino
https://www.youtube.com/watch?v=fCxzA9_kg6s
https://www.youtube.com/watch?v=_LCCGFSMOr4

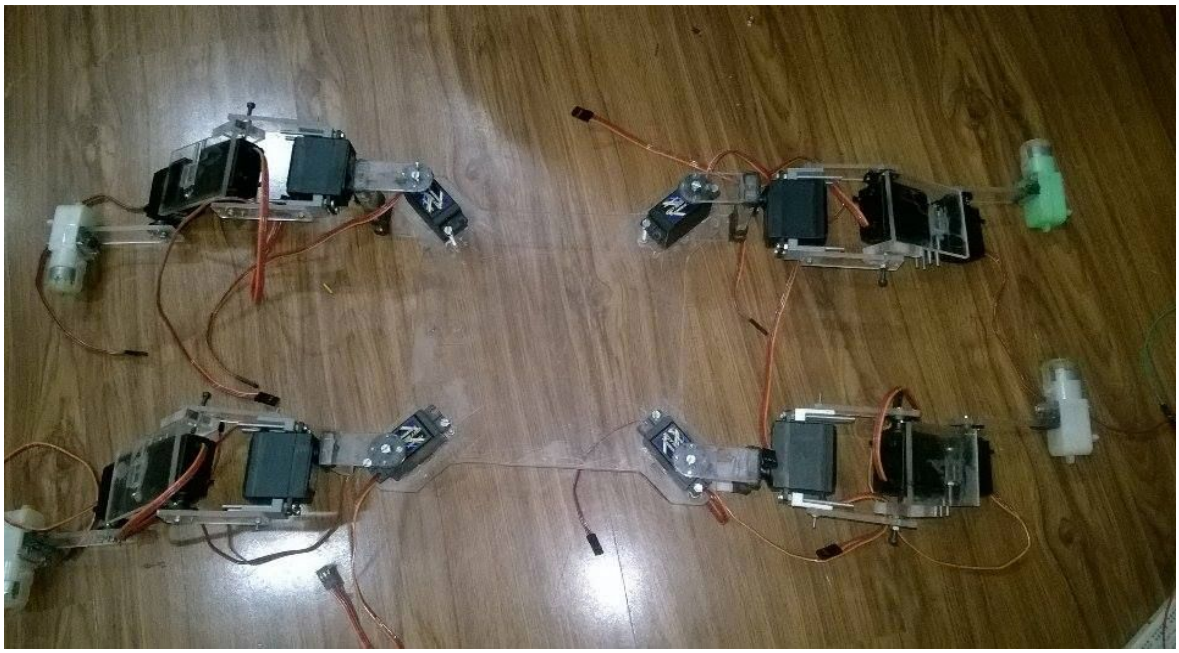
Pictures And Component List.
1.Start of the project.



2. Our bot in parallel state.



3. Different transformations of our bot



Components List

1. Servo motors (₹. 21,500)
2. Arduino Mega (₹. 4000)
3. Toy motors(₹.150) (Mangaldeep)
4. PCBs(₹.120) (Mangaldeep)
5. Ball Bearings(₹. 280) (P.P. Enterprise)
6. Jumper Wires(₹.400) (Mangaldeep)
7. Nuts & Bolts(₹.441)(Mangaldeep)
8. Copper Wire(₹.20) (Mangaldeep)