WALL CLIMBING ROBOT

CLUB: ROBOTICS CLUB

Video link : https://www.youtube.com/watch?v=Iva60Zq1T5c

INTRODUCTION :

Our project Wall Climbing Robot as the name suggests , is a bot able to climb on a wall inclined as much as up to 90 degrees to ground. Basically it works on suction mechanism where with help of suction cups and a vacuum pump the robot is able to stick to the surface of the wall.

MOTIVATION FOR PROJECT :

A robot that can move vertically along an unpleasant surface, for example, concrete, offers extensive military and citizen points of interest. Situated high on a building, the robot, serving as a perception stage, could give significant military insights and also support in hunt and salvage operations. It can also be used for cleaning glass windows of tall buildings .

CONCEPT BEHIND THE PROJECT :

1. TO ADHERE BOT TO THE WALL : For it we attached suction cups to 4 legs of the bot which are connected to 2 vacuum pumps (2 cups to 1 pump). These suction cups adhere to the surface of any ordinary smooth wall or glass.

2. MOTION : Our bot moves ahead using alternate leg movement. In the starting position all 4 legs make 45 degrees with the vertical and are below the body. First one leg set moves forward(upper right & lower left), cling to the wall, vacuum pump-1 starts functioning. Now, vacuum pump-2 stops, loosening the other two legs(upper left & lower right) which now move forward. When both leg sets are up and attached to the wall then the servos move in the opposite sense pushing the body up and then the cycle repeats.

PLAN OF ACTION :

WEEK 1

Planned:

1. To study the various ways of implementing the suction mechanism and movement of the bot, then to one choose one amongst them .
2. To learn about arduino and other electronics required for the project.

Accomplished :

1. Finalized the motion of the robot.
2. Got information regarding all the components to be used.
3. Brought the vacuum pump.

WEEK 2

Planned:

1. Test the suction mechanism and develop the basic structure of the bot.
2. Work on the coding required for the arduino.

Accomplished:

1. Brought the various basic components required including such as Arduino, suction cups, Vacuum pumps, chassis .
2. Tested the suction capacity of the pump and and the motion of servos.
3. Made the switching circuit for the vacuum pumps, and the circuit for servo motors.

WEEK 3

Planned:

1. Integrate all the components of the bot and test it.

Accomplished:

1. Integrated the components and started doing small tests on the robot..
2. Modified the legs of the robot, giving more stability.
3. Fixed all components permanently on the bot.
4. Tried to make it climb on a wall,and hence tested the vacuum capacity on different surfaces.

WEEK 4

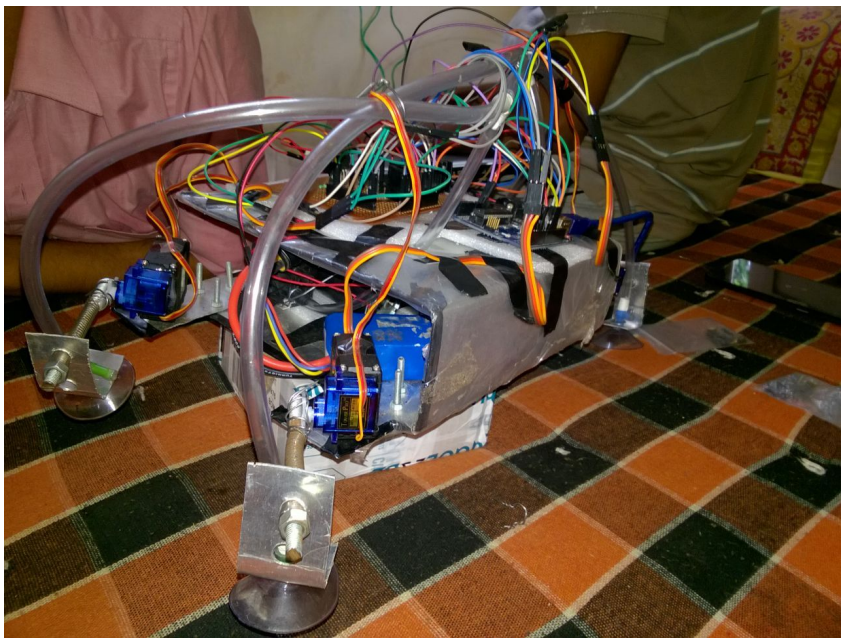
Planned:

1. Debugging and improvising the design for the bot to work as it should.

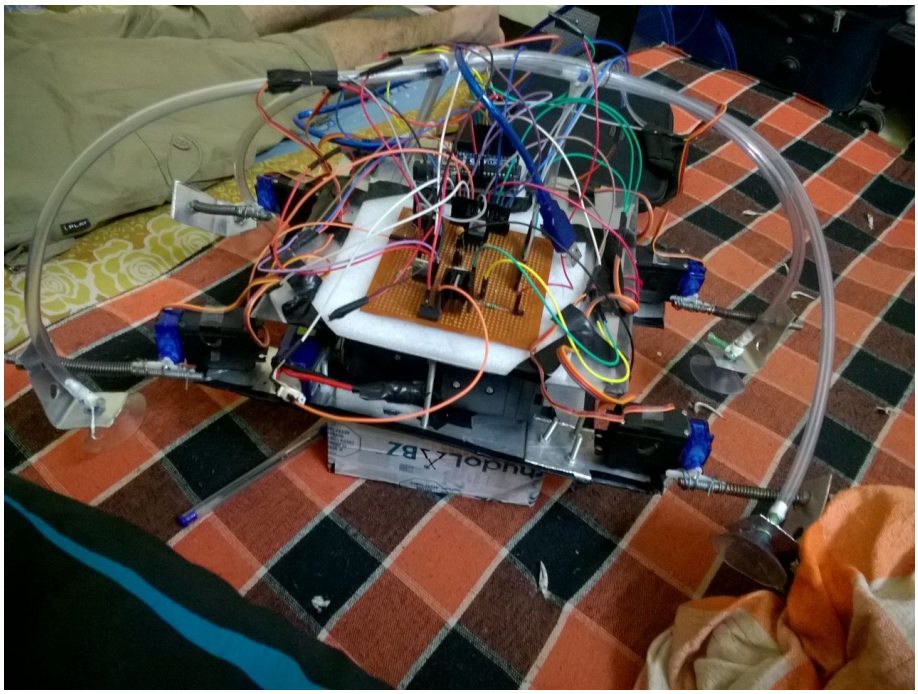
Accomplished:

1. Shortened the legs of the robot to make it carry much more weight.
2. Modified the leg of the robot to give it maximum stability and to keep it stiff while in motion.
3. Bought a better servo to replace the damaged one and further make motion more stabilized.

PROJECT PICS:-



SPRING LEG



SOLIDWORKS MODEL:-
https://drive.google.com/drive/folders/0B4w2TEi7IDPecVZfU0FIdnRXTXc

PROJECT DETAILS:-
How we reached our project-
-Using a transistor circuit switch for 2 pumps, 7805 circuit and arduino 8 servos (4 11kg cm and 4 2kg cm) and 2 pumps were controlled.
-The body used 4 legs. Each diagonal pair of legs were moved upwards and body was pushed upwards using 4 11kg cm servos with pumps switched on.
-2 kg servo was used to make suction cup leave and touch the wall.
-To control pumps transistor TIP-122 was used. A single pump sucks air from two alternate leg cups.When the legs in air pump remain in off position but when contact it gets on.
-The legs were made using spring inserted in rods so that body distance from leg end remain constant at the time body is moving up.
-Using arduino the motion was achieved.

PROBLEM FACED-
-Since body has to move against gravity various problems were faced during project.
-The major problem was to give spring legs only one degree of motion so that suction cup remains parallel to the surface and still spring contracts during motion.

-Another was to make spring feet movement over leg smooth as the force act during motion in tangential direction to contract the spring.
-Body topple from wall was also a major problem when only 2 legs are in contact with spring.To prevent this various tail type were also used.

LIMITATIONS-
-The 2kg cm servo proved very were weak and legs push body away from wal instead of spring contracting.So cups have to manually make in contact with wall.
-Now the the bot can only move upwards and not in all direction.

COMPONENTS REQUIRED :

1. Vacuum pump(D2028)(2) cost-Rs.3000
2. Suction cups(10) cost-Rs.180
3. Pipe connectors(8)cost-Rs.380
4. Pipe, cost-Rs.50
5. Metal legs
6. Aluminium body
7. Servo motors(4 mg995 & 4 sg90)cost-Rs.2300
8. Arduino Uno, cost-Rs.550
9. 7805 voltage regulator(2)
10. TIP 122 transistor(2)
11. 0.1 microfarad capacitors(2)
12. Misc. - connecting wires , supporting rods, screws,pins ,etc.

OUR TEAM:-

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http://ijact.org/volume3issue3/IJ0330018.pdf

The most basic motion idea of bot.

2.https://www.youtube.com/watch?v=RFekE6fIuRM
The sliding mechanism wall climbing bot.

3.https://www.youtube.com/watch?v=fCxzA9_kg6s&list=PLA567CE235D39FA84
Arduino tutorials.

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Basic idea about wall climbing robot and force calculations.

5.
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Tower pro MG995 servo motor

7.http://www.numatics.com/Common/PDF/Numatics-Vacuum-Products-Catalog.pdf
Information about vacuum generators and suction cups and various calculations involved