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Wall Climbing Rover Using Propellers

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Abstract: *The paper describes the design, implementation and experimentation of an wall climbing rover. The objective of our project is to create a four wheeled robot capable of climbing vertical territory using techniques similar to those used by flying drone. When a flying drone fly's in air/ free territory. Its uses its propeller's to create suction from one side which results in lift from ground. However the robot will be driven by control of user. A four wheeled robot was chosen after considering the robot's capability Instead our new approach leads to less cost and a different approach.*

I. Introduction

Various climbing robots have been developed over the past ten to fifteen years. Most of them rely on special robot hardware equipment's or tools. Amongst them STICKLYBOT[1] uses a rubber like material with tiny polymer hair's made from a upscale mold to mimic geckos feet while SPINYBOT[2] has feet equipped with many tiny claws. Another one is lemurIIB[3] was a four limbed climbing robot was made while keeping spider walking technique in mind. There is another robot was Tenzing.[4,8] It is a four limb planar robot same as lemurIIb. Over here it is provided with two revolve joint's in each limb and the moment was controlled. By motor which is at each elbow and shoulder joint. Then comes capuchin[5] it is based on how a human climbs a stiff surfaces or mountains by the grips of his hand. The same technique was used over here. In which it has four limbs and is capable of climbing autonomously planer vertical terrains equipped with arbitrary shaped and distributed features. It only uses frictional contact between its figures and another terrain features to maintain static. The literature survey was done by us on robot vertigo[6], disney research. This robot can climb wall very easily. The vertigo uses two tiltable propellers that create all that force that is needed can be tilted in every direction and this way robot stays on the wall . The vertigo is controlled by user like a remote controller. Another 90 degree wall climbing robot was developed by SRM university[7] students in year 2013-2015. The robot climbs the wall in both vertical and inclined condition's using the suction force of the centrifugal blower fans, the robot sticks to the wall and conveyer belts rotates for the robot moment.

As we have seen many people/projects have used different techniques some use the 4 leg way, some use suction cups, while some use propellers. What we have done is combined all this techniques. From the different rovers making it one. Instead of limbs we can use wheels, which will help the rover to move freely in every direction. Propellers which will produce suction to keep the grip with the wall or surface. As the suction which is produced must concentrate in one direction rather than spreading in all directions. Hence we used a plastic sheet to create a base around propellers which provides us more suction. And at the end we create ATMEGA328P board to give the rover all the commands and supply.

II. Block Diagram and Working

In this project, the overall block diagram consists of a Bluetooth model,ATMEGA development board,L2939 a motor driving IC, ESC, DC motor and BLDC motor. Over here each and every block has its separate working and function. And they all together are controlled by ATMEGA Development Board which is been commanded by user as it's a user interface device. In this the Bluetooth module is used to make the rover a wireless device which can operate to a particular operating range. From and with the help of module we can give operating commands to the device.

It also consist of a battery supply to the rover, the battery supplies the required power to the device for a certain period. It also consists of two types of motor that are BLDC and DC motor. We need two BLDC motor for the propellers and also ESC for the BLDC motors. The ESC is used for the conversation into three phase ad BLDC runs on three phase. We also require four DC motors. We need L293D which is motor driver IC. As one motor driving IC can drive two wheels and in this project we split it into four wheels. And all this is controlled by ATMEGA development board

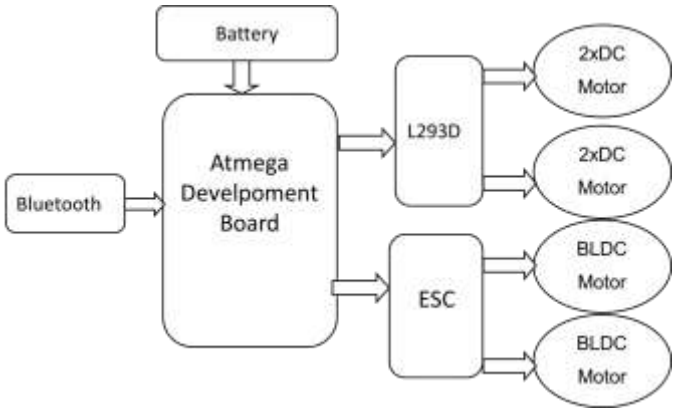

Figure 1: Block Diagram of Proposed System

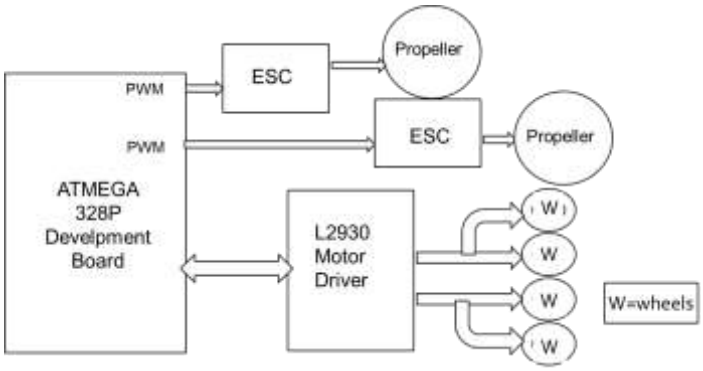

Figure 2: Block Diagram of wheel and propeller movements

Basically the whole climbing of rover has a rectangular frame and consists of six motors out of which the motors are categorized into DC motors and BLDC motors. We require four DC motors for driving the rover for the forward and other different directions and the remaining two BLDC motors are used for the propellers. We require two ESC for the BLDC motors for the conversion into 3 phase signal. Also we require L293d which is an motor driving IC. The motor driving IC (L293d) which is used by the DC motor. As we know that with the help of a single (L293d) we can drive two different DC motors but in this project we use only single module of (L293d) motor driving IC and split into such a way that all the four motors are driven and the only reason behind this is to reduce or else decrease the weight of the project. The basic hardware components required are propellers, ESC, Motor Drier IC (L293d) , Four Wheels , Plastic frame and the controller ATMEGA Development Board. We have four wheels that are numbered as follows.

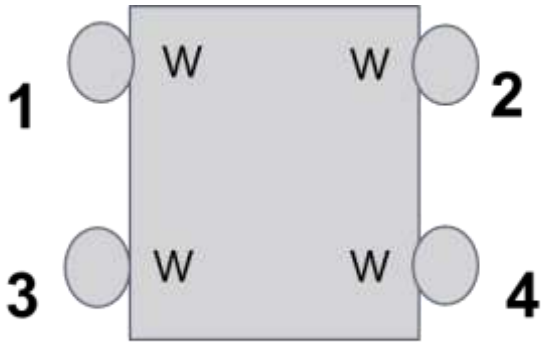

Figure 3: Operation of Wheels

Basically it carry outs the different movement such as forward, reverse, turning left and turning right in forward and reverse direction. Now if we want the rover to move in forward direction then the wheels (1) and (2) are given Logic ' 1 ' and the wheels (3) and (4) are provided with Logic ' 0 ' and vice versa for the reverse direction. Similarly if we want to move the rover into left direction then the wheel number (1) is applied Logic

' 0 ' and rest of the wheel are provided with Logic ' 1 '. Similarly for turning the rover to the right direction then wheel number (2) is given logic ' 0 ' and the remaining wheels are provided with Logic ' 1 ' .

Now in the explanation above

Logic ' 0 ' means Logic ' LOW '

Logic ' 1 ' means Logic ' HIGH

Now in this module we have taken the concept of a drone. As we know the drone uses the propeller to life itself against the gravity. When the propellers are rotated in the clockwise direction the drone is been lifted in the above direction. We are using the similar concept but in a different manner. We are going to rotate the propellers in anticlockwise direction by doing this a suction vacuum will be created below and due to this the rover will stick itself toward the base below or the surface. We have taken two propellers and we use ESC for each propeller. As we have two propellers we require two ESC. Here ESC is the Electronics Speed Control which is used for the conversion into 3 phase for the propellers.

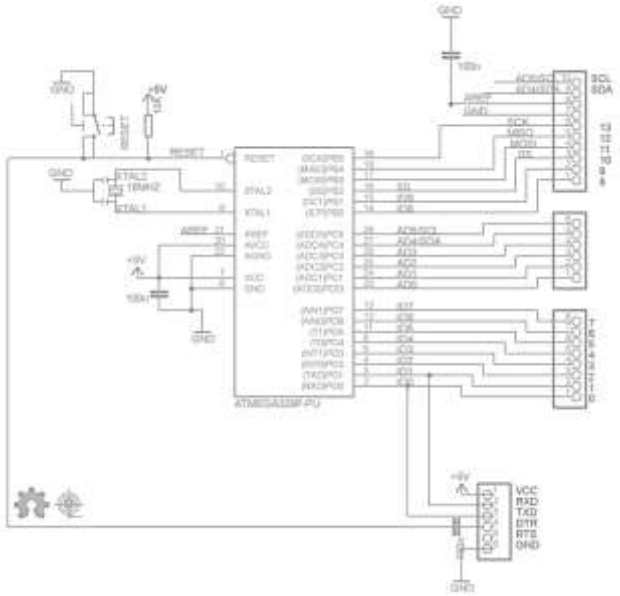

Figure 4: Circuit Diagram of ATMEGA 328P Development Board

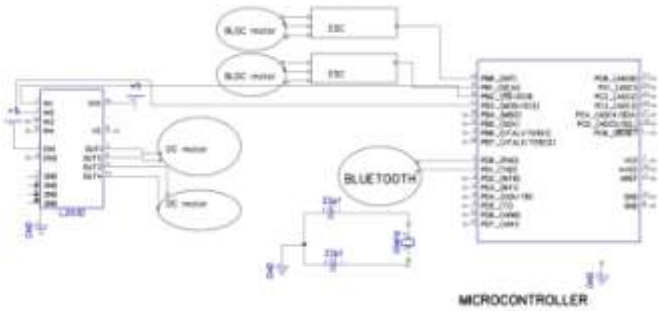

Figure 5: Circuit Diagram of overall proposed system

Bluetooth will transmit signal to the ATMEGA328P IC . If the signal like up, down, left & right is to be given those signals will be received by the L2983D. The signal will be received by the motor by the designated IC. According to that the direct decision will be taken by the device this will activate the function to move in the different direction. In case climb signal is given so that the device might climb a steep surface then the a Development Board of ATMEGA328P will process the signal the signal present here is the Bluetooth signal and this signal will be sent to ECS (Electronic Speed Control) then that signal will be sent to the BLDC motor which is nothing but our propeller. And in this way the device

III. Conclusion

Hence we have built a device that is almost able to CLIM a steep surface. According to the researches done before it was difficult to CLIM a steep surface or else the cost of the device was to expensive. The major problems faced while building this project was that the device used to fall of the surface while climbing or else

the device used to get heavy enough that it could not create a vacuum that is strong enough to stick at the steep surface in our case (90°) surface. The main uses of this project is that this device may be used for military purpose and this is the biggest achievement so far we can see. As the drones are not always possible at certain places we can use a device such as this and get the job done. This is cost efficient and the efficiency of the device can be increased by slight modifications as per the requirements of the consumers.

References

[1]. S. Kim, M. Spenko, S. Trujilo, B. Yeyneman, V. Mattoli, and M. Cutkosky, "Whole body adhesion: hierarchical, directional and distributed control of adhesive forces for a climbing robot". IEEE Intl. Conf. on Robotics and Automation, pages 1268-1273, April 2007

[2]. A.T. Asbeck, S. Kim, and M.R. Cutkosky," Scaling hard vertical surfaces with compliant microspine arrays." The Int. J. of Robotics Research, 25: 11651179, 2006

[3]. R Zhang, P Vadakkepat, CM Chew, J Janardhanan. " Mechanical design and control system configuration of a humanoid robot." Proc. of 2nd Int. Conf. on Computational Intelligence, Robotics and Autonomous Systems 2003

[4]. P Vadakkepat, NB Sin, D Goswami, RX Zhang, LY Tan, "Soccer playing humanoid robots Processing architecture, gait generation and vision system" Robotics and Autonomous Systems 57 (8), 776-785

[5]. Jean-Claude Latombe,Oussama Khatib, Kenneth Salisbury." Design and implementation of an autonomous climbing robot" , a dissertation submitted to the department of computer science and the committee on graduate studies of stanford university.2014

[6]. ETH Zurich/Disney Research, Vertigo, 2015

[7]. SRM UNIVERSITY students in year 2013-2015

[8]. S.P. Linder, E. Wei, A. Clay. Robotic rock climbing using computer vision and force feedback. Proc. IEEE Int. Conf. Robotics and Automation, pages 4685- 4690, 2005.