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WALL CLIMBING ROBOT

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ABSTRACT
In this paper, we work to achieve a robot which is capable of climbing vertical walls with the aid of passive cups using suction force. The passive mechanism is so simple. Also the system does not require more energy to climb the wall or stay on the wall making the system very attractive. Also the ability to stay in the wall without any hindrance makes it more efficient. The strong attractive adhesion on the wall can be broke by pulling it out and until then it remains on the surface. Our robot is 14cm tall and 35 g in weight. It has three degree of freedom. It can travel with a velocity of 3m/s and climb at a velocity of 2m/s.

KEYWORDS: Robot, Legged Robot, Vertical Wall Climbing

1. Introduction

Robots cane be used to simplify the manmade work. In order to do the work in an efficient manner and without tiring robot can be used. One of such robots is Wall climbing robot which can be used for climbing vertical walls under load and also perform tasks such as inspection of tanks, cleaning process, reconnaissance. It can also be combined with land robots. Their mobile technology can be combined with the wall climbing robots. Also adhesion technology can be used for sticking purposes. Adhesion method selection is an important criteria for wall climbing robots. Existing adhesion methods are mostly negative air pressure and magnetic force. Lot of research has been done on these methods. Although a common technology, In order to use air pressure we need a pump or fan which increases the load of the robot. Also due to sealing problems, they are limited to smooth surfaces and nonporous surfaces. Magnetic adhesion can produce a high suction force and is relatively simple.

One of the objects having a vast application is engineering is the wall climbing robot. Already it has been analysed to prove that the existing adhesive methods are suitable for specific applications. Even a simple crack can lead to suction disc leakage making the robot fail. Dust on surfaces can have negative effects on the attachments on the robot.

If the structure is unsuited for work like watery, rocky, rough concrete surfaces, bricks, rocks likely those found on high structures like cable bridge towers then the traditional adhesion design will not be suitable. These structures are from remote mountain areas where winds

will be rough and they might cause the entire structure to vibrate. Here there is a high demand for attachment devices which could hold in spite of heavy negative forces which act against the robot. Here we need trained manned workers using steel ropes and hydraulic lifts to risk themselves for the work.

2. Methodology

Hence in order to overcome these difficulties in traditional systems, we utilize a famous biped system model in our project. It has been shown. There is two 6-DOF legs. For each leg, there is a hip joint with 3 DOFs. It also has a knee joint which acts a pivot point with one DOF. It has a lower leg which is a general joint with two DOFs. Also there is a waist joint which is located at pelvis pivots in space to stroll the carriage of the upper body. Invention of this project implement of spy camera controlled by electronics control unit which is used in military purposes, it can be used in drainage cleaning process.it is also used in industries area for painting and cleaning.

NOTATIONS OF TRANSFORMAIONS		
Symbol	Start Frame	End Frame
T_{LF}	Global	Left Foot
T_{RF}	Global	Right Foot
T_{RF2LF}	Right Foot	Left Foot
T_{RF2PeL}	Right Foot	Pelvis
T_{PelLF}	Pelvis	Left Foot
T_{pel}	Global	Pelvis
The Notations Of T_x represent the six dimensional 4*4 homogeneous transformation from the start frame to the end frame. $T_1, T_2, T_3 \ldots\ldots T^{12}$ are homogenous transformation matrices determined by D-H parameters of segments.		

3. Comparison

Our primary goal was to focus on a design which has a wall climbing robot with great efficiency at a low cost. When compared to other wall climbing robots with various mechanisms and technologies it has an upper edge. The above table tells about our robot specification with a vacuum caterpillar wheel system robot. It also covers the cost.

4. Experiments and Results

4.1 Working Processor

This Wall Climbing robot is a mechanism where process works on gears which can be trusted under all atmospheric conditions of air, and also in places where air pressure is very low or no-air like outer space another concept for gripping like magnetic or adhesive process can be introduced. The work has to be done through a process in which the robot is made both lighter and stronger. A strong body can be obtained by adjustment between vacuum chamber (suction cup) and the ducted fan which makes the process several times lighter but stronger. It also uses a lower range Bluetooth technology for wireless communication which provides a communication range. But it is a limited range. Thus using suction cups in spring component is our main idea.

4.2 Results

Our results contain our experimental results of the robot. The robots rolling, crawling and wall climbing were experimented and tested, results have been identified. Initially our robot is a scorpio robot. Initially the crawling was tested. An open space without any hindrance was selected for the purpose. The robot was allowed to crawl by avoiding the obstacles on its way. It was observed that it crawled without any hindrance. We transmitted the on-board data from the robot using an IMU sensor to a remote computer for analysis using an Xbee module. The crawling location has been a flat and concrete surface. Next we choose a location to perform rolling motion and analysed the results over time. The measured IMU date while rolling was performed was recorded. Next the wall climbing properties were tested. A lain glass wall has been selected. The robot was attached to the glass wall and ascending and descending motion was performed. It was analysed and the data were transmitted in a similar way. All the modes of locomotion was successfully shown by the robot during the testing period. The acquired data is used to validate the pitching, yawing and 5olling in the robot. It also gives details about change in its acceleration during the performed actions. It also gives details about its recovery and transformation traits during switching between various motions during processes. The wall climbing ability of our project is due to two principles. One is the micro sized suction cups in the air sticks that establishes a great bond between the wall surface and the robot. It has thousands of microscopic air

pockets so that partial vacuum is created during the process which brings a great suction force. Also the tape used for adhesion in our robot does not depend on pressure leaving no reside behind. It can be used multiple times and still can have its holding power intact. The next is atrial bipedal location mechanism commonly seen in apes used for moving up and down on walls. This is achieved by a micro-suction-enabled closed link legs that move in rythm with the central trunk. It also uses a motor to generate this rhythmic pedalling. It's a 7.4V D.C Motor with three pairs of shafts and offset wheels. It has a spur gear mechanism to engage the DC Motor. The motor is driven by a DC controller. Pedals are attached at the end of wheels to generate the pedallic motion. The clockwise and anti-clockwise rotation of the DC motor produce the forward and reverse pedalling. An ATMEGA 328 on-board microcontroller IC is used as the processing unit. It also has Inertia Measurement Unit (IMU) sensors, servo controller and DC motor controller.it is having other advantages , that are it will give safety to human in their working area , it also can be work as a throne camera , we can develop this as a human security in bank,industries,etc..,

5. Conclusion

This Wall Climbing robot is a mechanism where process works on gears which can be trusted under all atmospheric conditions of air, and also in places where air pressure is very low or no-air like outer space another concept for gripping like magnetic or adhesive process can be introduced. The work has to be done through a process in which the robot is made both lighter and stronger. A strong body can be obtained by adjustment between vacuum chamber (suction cup) and the ducted fan which makes the process several times lighter but stronger. It can used for information collecting by attachment of cameras, transmitters and microphones. It can also be used to stream media. Arms can be attached on it for picking and handling purposes. Also X-ray scanning devices or extinguishing devices also can be used for rescue operations. AI can be added to it to make instant decisions.

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