



Design Practicum (IC201P) 2023

Group 11

Metallic Wall Climbing Robot

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Main Features

- Can easily move on vertical ferromagnetic surfaces and can navigate along the x and the y axis.
- Costs less compared to other bots in the market for industrial purposes, so it would serve as a one-time investment for the consumers.
- It is light-weight and has a reasonable size.
- Can be used for many purposes, for e.g., sending a live camera feed to the user while inspecting the surfaces
- There are many wall-climbing robots available that use the concept of navigating on the wall via suction using a vacuum and compressor, but they are extremely slow. Our bot works on the principles of electromagnetism.

Challenges faced

- Magnetic strength and load capacity of magnets:
Finding electromagnets such that the bot stays in contact with the metallic surface but climbs as and when torque is provided.
- Selection of motor:
Selecting stepper motors that provide sufficient torque for the wheels to rotate
- Selection of body material
The bot must be as lightweight as possible, hence choosing a material was a challenge. We decided to use 3D printing.
- Battery selection
The battery (LiPo Battery) should provide sufficient power for the bot to work.

Market Survey

Some of the existing products in the market:

- Remote-controlled wall climbing car [1]
 - Cost efficient toy cars
 - Cannot perform industrial tasks
- Crawlerbot [2]
 - Used to measure the density of asphalt silo walls and automates the process of taking measurements manually.
 - Has very limited application
- Geco Wall Climbing Bot [3]
 - A Research project on wall climbing bot using impeller technology.
 - Have adhesive pads on their feet that can stick to the surface due to van der Waals forces



Social Impact

- Industrial Inspection: In industries such as oil and gas, chemical, and power plants, metallic surface climbing robots can be used for inspecting hard-to-reach areas of equipment and structures, including pipes, tanks, and walls. This can help identify potential safety hazards and prevent accidents.
- Search and Rescue: In the event of natural disasters or emergencies, metallic surface climbing robots can be used to search for survivors and navigate damaged tanks.
- Military and Defense: Climbing robots can be used by the military for surveillance, reconnaissance, and other tactical purposes, including inspecting structures and detecting potential threats.

Achieved Objectives

- The maintenance and inspection of metallic vertical surfaces, tanks, and pipes are complex and dangerous tasks, requiring skilled personnel and equipment.
- The current methods of accomplishing these tasks involve human intervention, which is time-consuming, expensive, and poses a significant risk to workers' safety.
- Our bot can automate these processes. It should be able to operate in various environments, including harsh conditions, and be easy to use and maintain.
- It is cost-effective, making it a valuable tool for companies and organizations that require regular maintenance of their metallic vertical surfaces, tanks and pipes.

References

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- [2] D. Greenfield, "Rise of the wall-climbing robots?," Automation World, 25-May-2017 [Online]. Available: <https://www.automationworld.com/factory/robotics/blog/13314816/rise-of-thewallclimbing-robots>. [Accessed: 14-Apr-2023].
- [3] C. Rob and Instructables, "Geco - Wall Climbing Robot," Instructables, 21-Sep-2017. [Online]. Available: <https://www.instructables.com/GECO-Wall-Climbing-Robot/>. [Accessed: 14-Apr-2023].