Text Spraying Mobile Car

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Problem

Despite the growth of urbanization highlighting needs for text-spraying in areas such as advertising and venue decoration, the industry still relies on traditional manual labor and robots with capabilities limited to wall painting. This dependence leads to health risks, inconsistent quality as well as failure in meeting individual text spraying needs, posing a challenge for target customers such as governments, shop owners, and event organizers.

Concept Generation

Our project aims at building a text spraying mobile car which could spray text in accordance with input, thus prioritizing safety, text quality, personalized text spraying needs, and flexibility.

Design Description

Our solution, integrating hardware and algorithmic control, begins by aligning itself with the target wall using its Mobility Unit. Upon user input, the Dot Matrix Algorithm designs a path for the Paint-Spray Module. These paths are then communicated to the X-Z Motion Platform, guiding the Paint-Spray Module both horizontally and vertically. As the platform moves, the module sprays paint, creating the text on the wall. The car continuously adjusts its position for each letter, ensuring the entire text is accurately rendered on the wall.

Hardware: Fig. 1,2,3

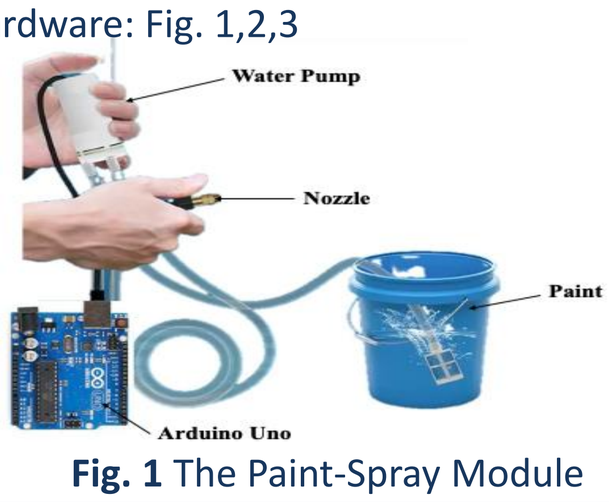

Fig. 1 The Paint-Spray Module

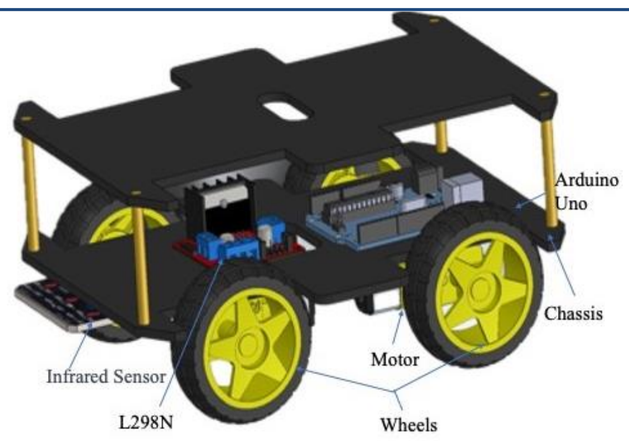

Fig. 2 The Mobility Unit

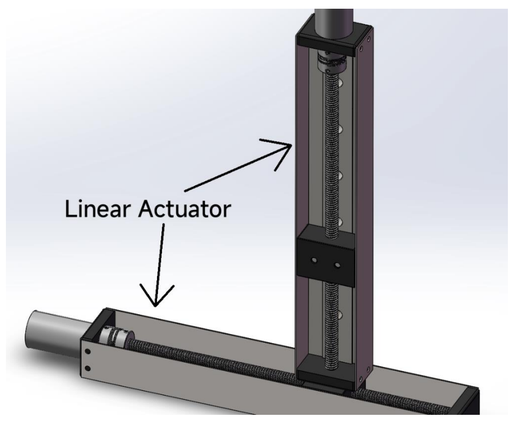

Fig. 3 The XZ Motion Platform

Algorithm: Fig. 4

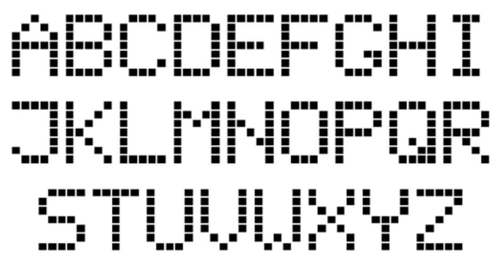

Fig. 4 Dot Matrix Letters

Modeling and Analysis

The realization of our project is predominantly divided into four key components. Firstly, we redesign the paint spraying module by selecting nozzles and pumps. Then, we employ TB6600 and L298N for Arduino control of linear stages and linear actuators, ensuring precise vertical and horizontal positioning of nozzle. Next,we create a Dot Matrix Algorithm that includes pathways for all 26 letters and interprets input text to meet personalized text spraying requirements.Finally, we incorporate a line tracking module with IR sensor for multiple text spraying processes.

Validation

We conducted two sample tests:

1. Simulating operation of the text-spraying mobile car.
2. Positioning the nozzle at different distances from the wall to model volume distribution of water.

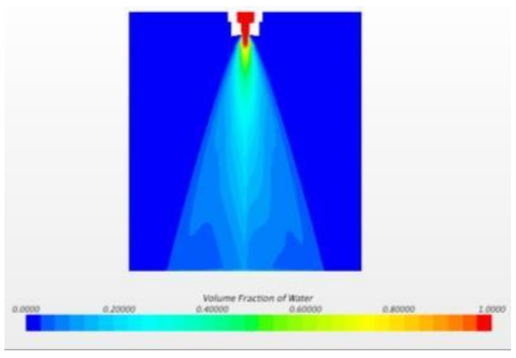

Fig. 5 Volume Fraction of water for a wall distance of 100mm

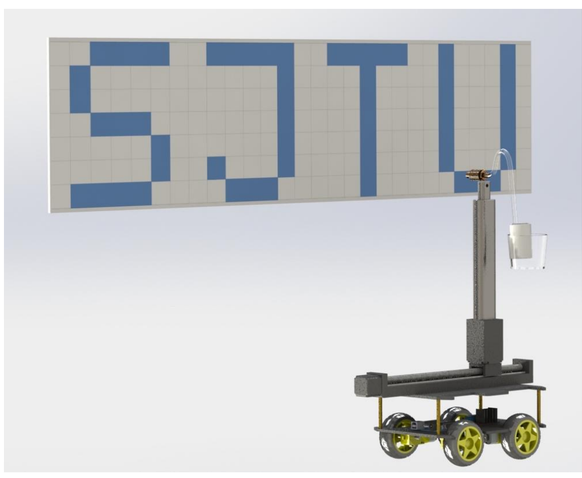

Fig. 6 Simulated Spraying of "SJTU"

We note that the nozzle generates a focused beam near the wall at a short distance, enabling accurate paint spraying required for the dot matrix design of letters.

Conclusion

In conclusion, our system can successfully achieve text-spraying based on input, delivering high-quality results tailored to personalized needs, while minimizing health risks. This system proves crucial in advertising, slogan display, and venue decoration, making it vital for governments, business owners and urban developers. Potential improvement involves the expanding capability to generate intricate patterns beyond textual content.

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