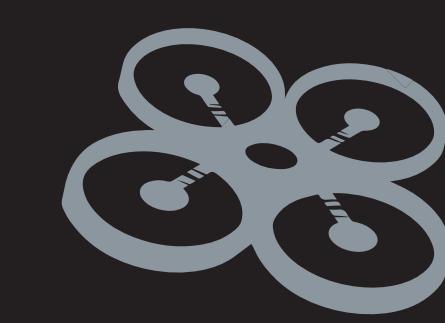
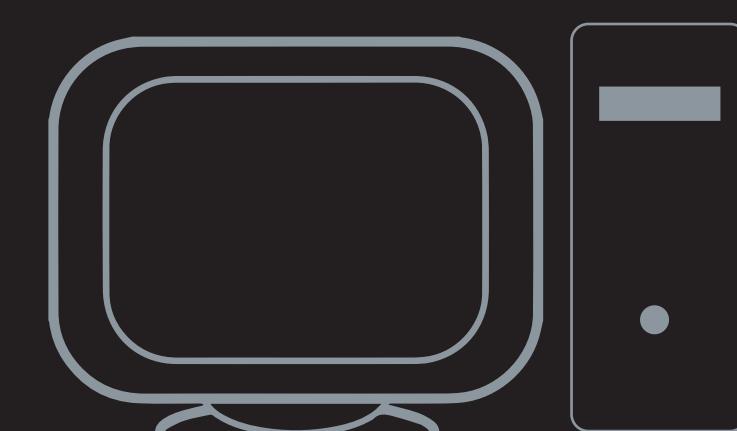


Automatized Wall Painting Drone



Abstract

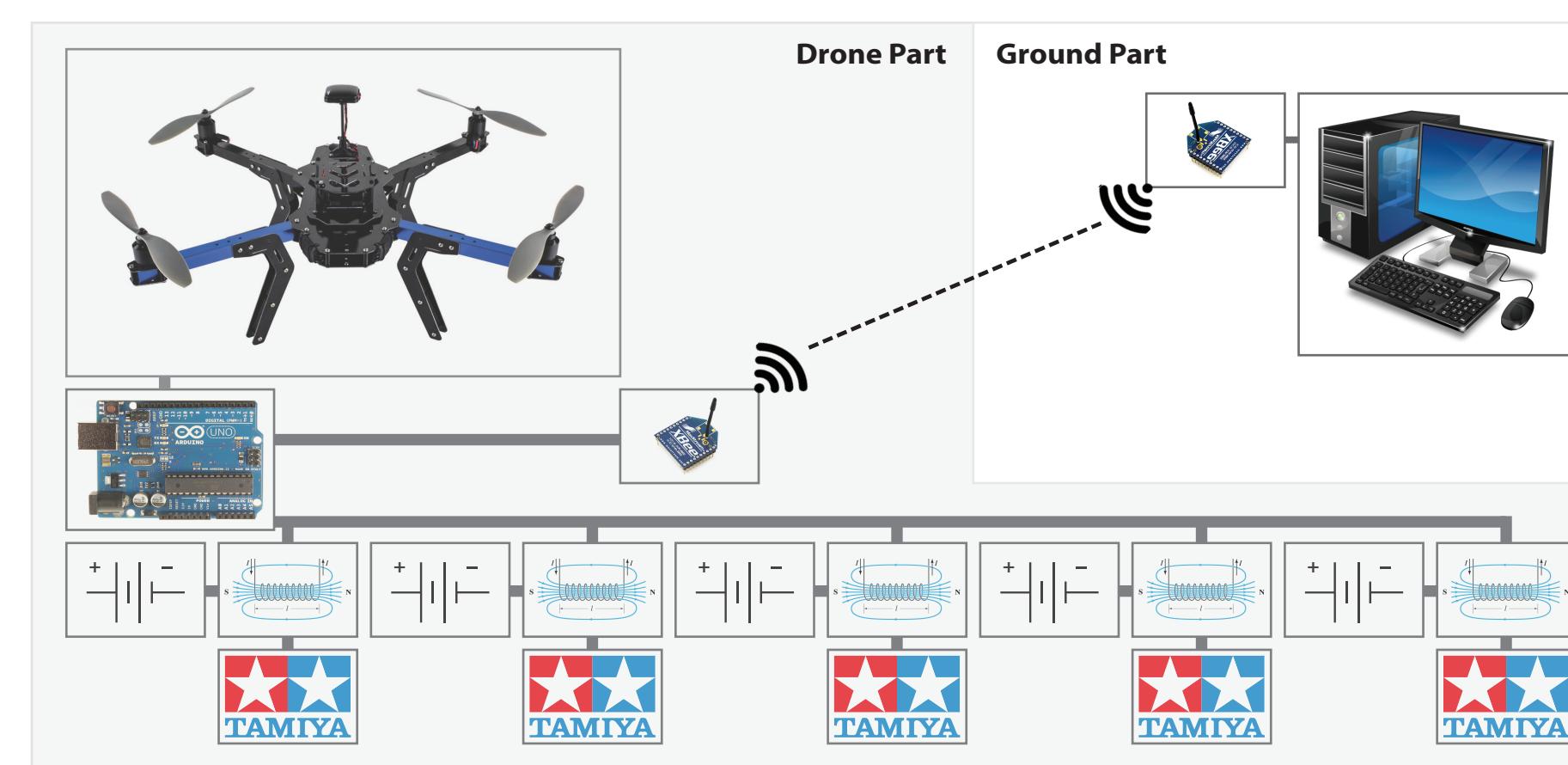
We developed a drone that is able to draw pre-decided images on a wall on an automatized basis without human interaction apart from the picture input. This method of painting is useful because painting buildings is a costly and dangerous task to perform by humans. Since a drone and computer vision is used we can perform paintings not only with a single color, but also paint multicolored images. Design is built upon the concept of a dot matrix printer, and a flying quadcopter functions as the printhead. An array of computationally actuated spray-cans is attached under the quadcopter and release paint as the drone flies along a surface. Our results demonstrate that our approach is promising and that it is safer and more cost effective compared to human painters.

Methodology

- Spray paint test
- Spray cap test
- Optimal spraying distance test
- Primitive painting system test
- Designing advance painting system using insights from previous tests
- Painting system test
- Drone assembly
- Drone calibration
- Pixhawk programming
- Arduino programming
- Distance sensors application
- Designing circuit for the system
- Drone testing
- Protection system
- Assembly into unified system
- Interim testing
- Error fixing
- Final testing

Results

The drone received input (text) from the ground station through wireless communication. Once input is received the drone is moved to the location the drawing has to be completed and starts moving to the right, and depending on its location from the wall on the left, appropriate solenoids are actuated. The final test of our Automatized Wall Painting drone is shown below. The intention was to draw "KAIST" on the wall in a laboratory conditions. Clearly, the image is easily identifiable and presents good accuracy. Despite of our efforts to produce high quality image, some errors in drawing can be identified. This happened because the distance sensors showed false measurements and painted got released earlier/later than it was supposed to be released.



Conclusion

By using Arduino Board, DIY drone from 3D Robotics Company, 3D printing techniques as well as knowledge of programming languages we developed a prototype of the drone which is capable of making letter drawing on a wall. The results of our final testing demonstrated good results and decent quality as well as shown us direction to improve our prototype. In particular, improvements needs to be done for painting system: occasionally some of the spray cans do not release paint at a decent strength to generate good quality as shown were discussed in the Results section; improvements has to be done for the drone autonomous flying: stability and safety deserves to be improved. Even though, the main goal of the drone was achieved, there are some objectives that have not been fulfilled yet. In particular, when interrupt occurs the possibility of renewing painting works from the last position has not been programmed. Also, when painting jobs are completed we originally planned to return the drone to the original taking off position. However, due imprecise GPS tracking inside the building where we tested our system, this objective was postponed to be completed in the future.

Future Development

The proposed prototype is definitely not the optimal solution for the problem and number of improvements could be made. The weight of the system can be drastically reduced by limiting the painting system to only one spray can. However, then we will require a stabilizing platform. As discussed in the Results section, occasionally some parts of the drawing gets shifter due to false reading of the distance sensor that was used. Alternatively we can switch to LIDAR distance which provides great performance up to 40 meters with an accuracy of 5% (+/- 2.5cm) in the worst case. Image quality can be increased by improving drone's stability and by designing lighter and more robust painting system that would be able to sustain great values of drone oscillation and show continuous performance under such conditions. During the painting process, there could be a moment that can is out of spray can and it should be changed to new one. Such operation requires some kind of tracking system which would notify the user about the paint level status or detect when paint is not released.