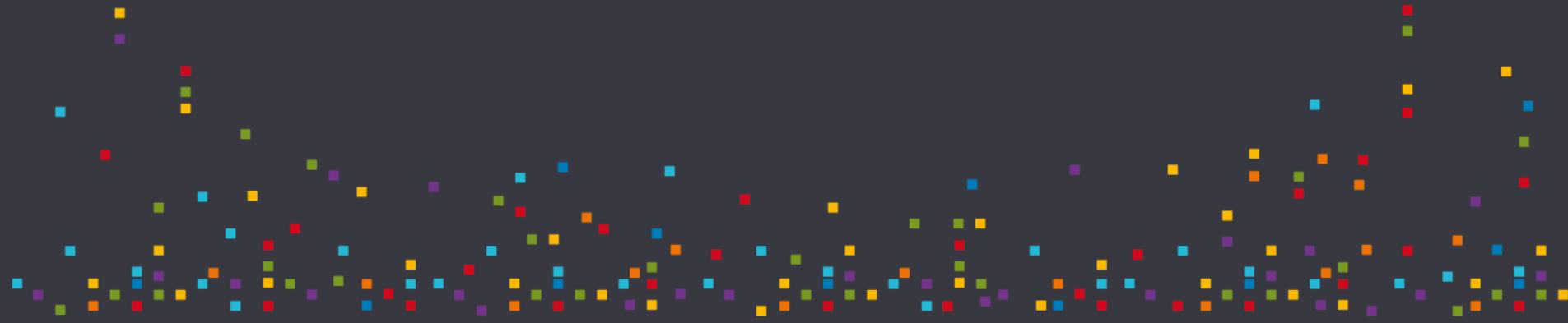




UNIVERSITY OF OSTRAVA
FACULTY OF SCIENCE

An indoor space mapping with a drone

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Motivation

- The practical usage of space or environment mapping through a flying drone is gradually growing.
- Applied in:
 - archeology,
 - environment geography,
 - search and rescue.



Motivation

- The indoor mapping is still not a very explored area of a research.
- Indoor mapping and modular control for uavs and other autonomous vehicles, and associated systems and methods, patent, 2018,
<https://patents.google.com/patent/US20180217614A1/en>.
- Proposed solutions are often designed for a specific architecture.



Current approaches

- Technology:
 - Lidar, camera, barometer, accelerometer, gyroscope.
- Correction and estimation algorithms such as:
 - Kalman filter,
 - Bayesian filter,
 - Particle filter, etc.
- SLAM.
 - Dynamic changes in space can disrupt the localization.

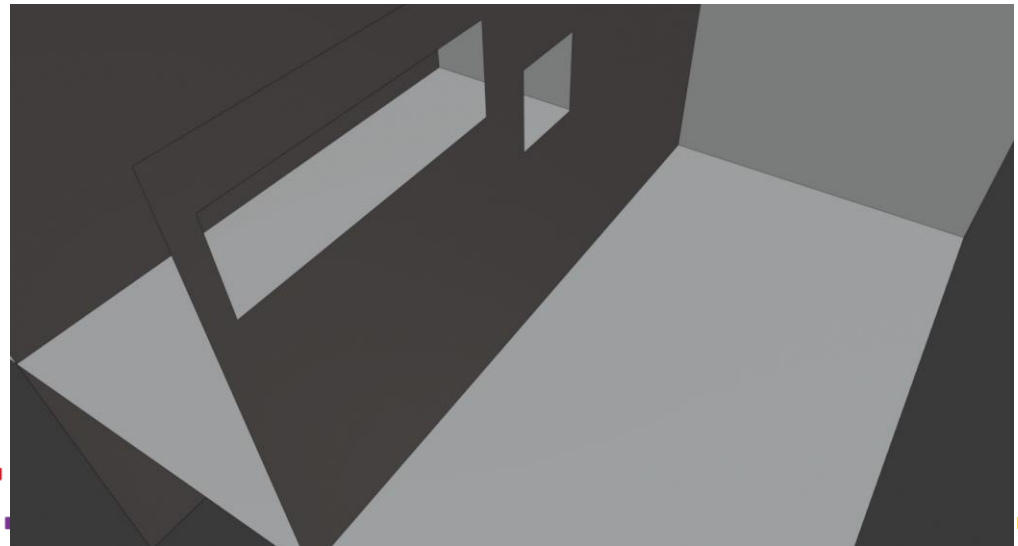


Indoor assumptions



- Always a path.

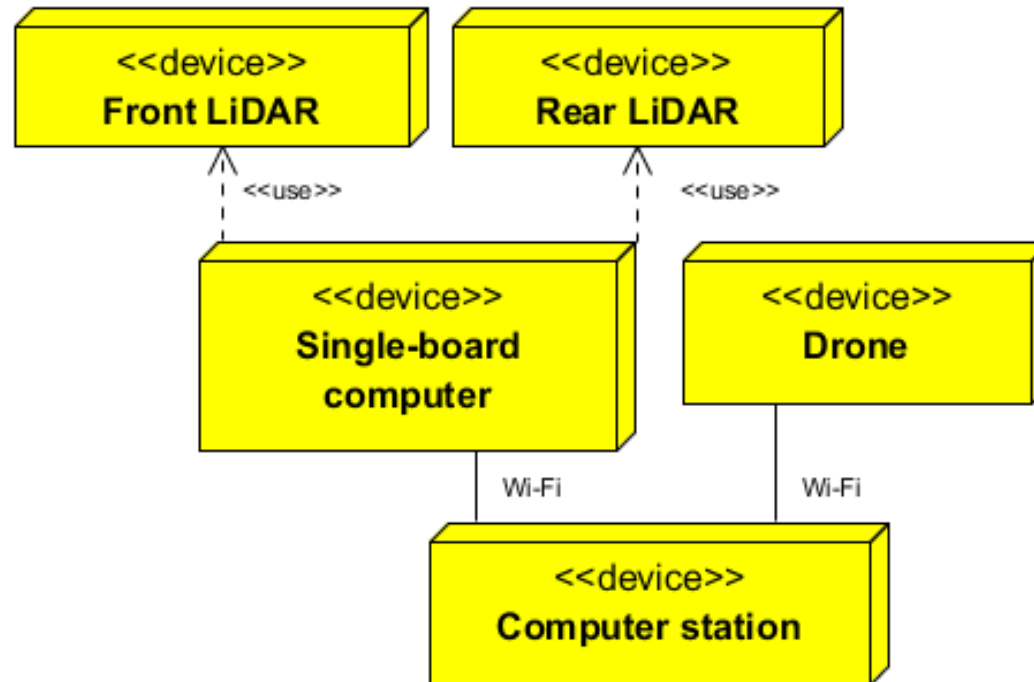
- Searching entrance in vertical space.



Exception



Drone architecture

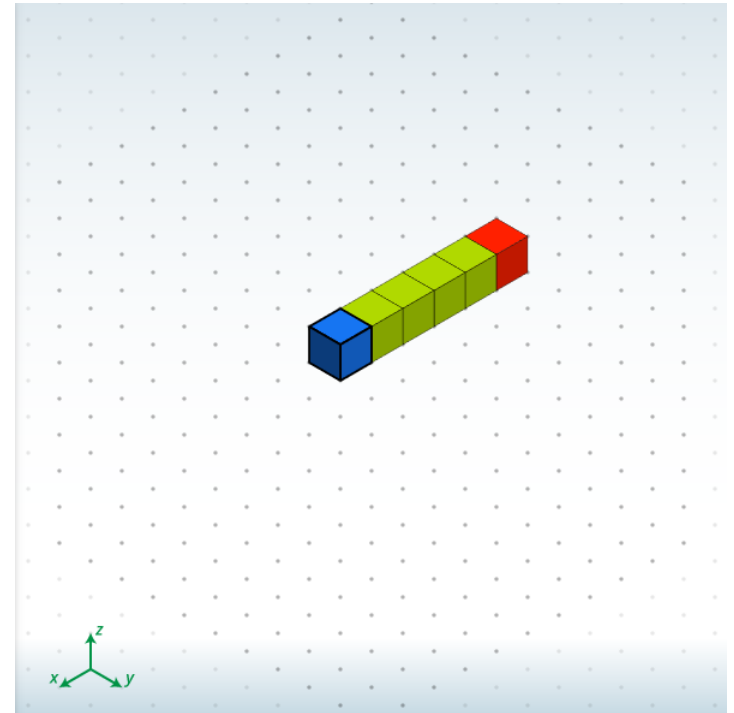
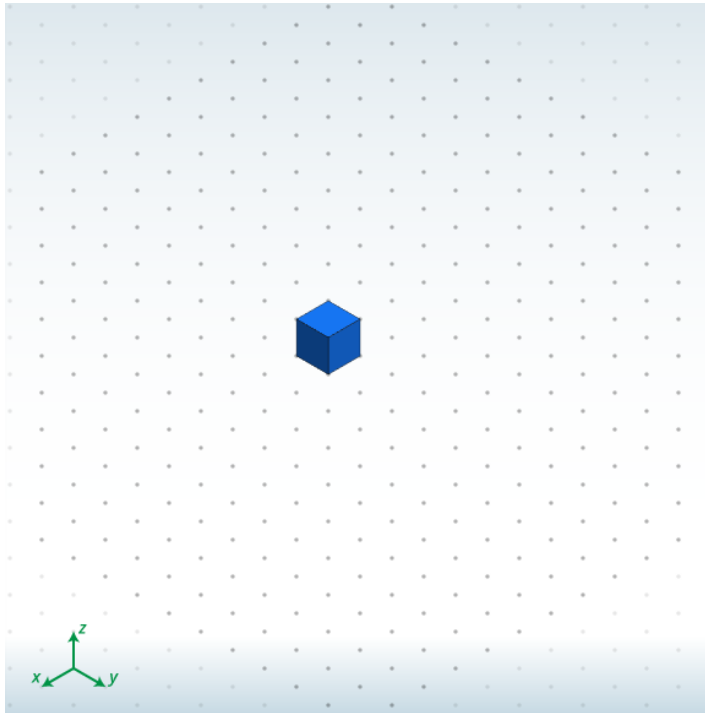


Our mapping algorithm

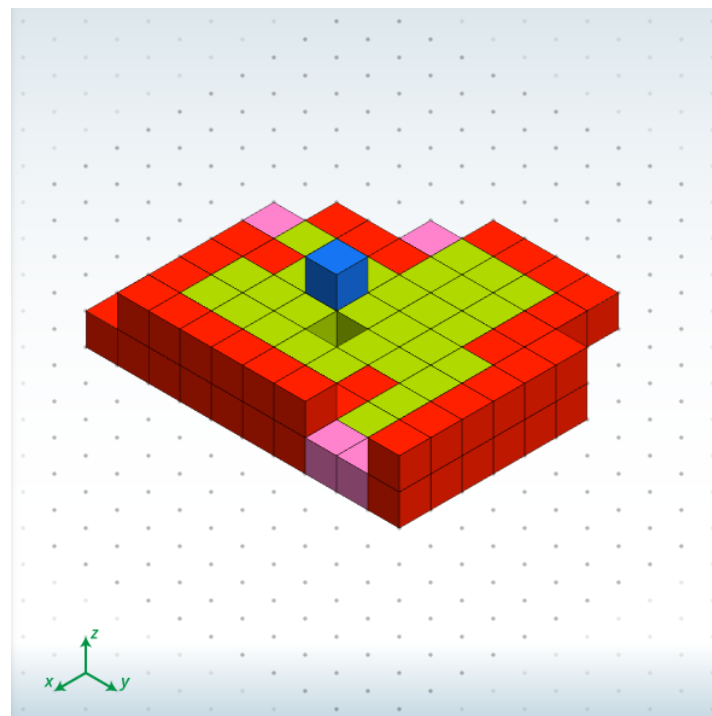
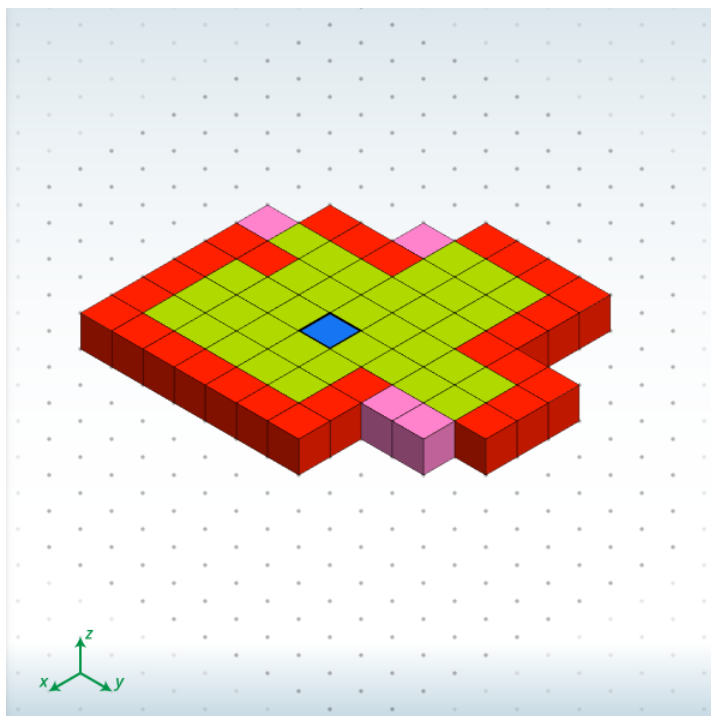
- Based on the frontier exploration algorithm.
 1. Create a 3D occupancy grid from the space.
 2. Rotate the drone around its axis.
 3. Change altitude for better results.
 4. Check for remaining unknown cells.
 5. Move to the nearest one.
 6. Repeat until there is no other unknown cell.



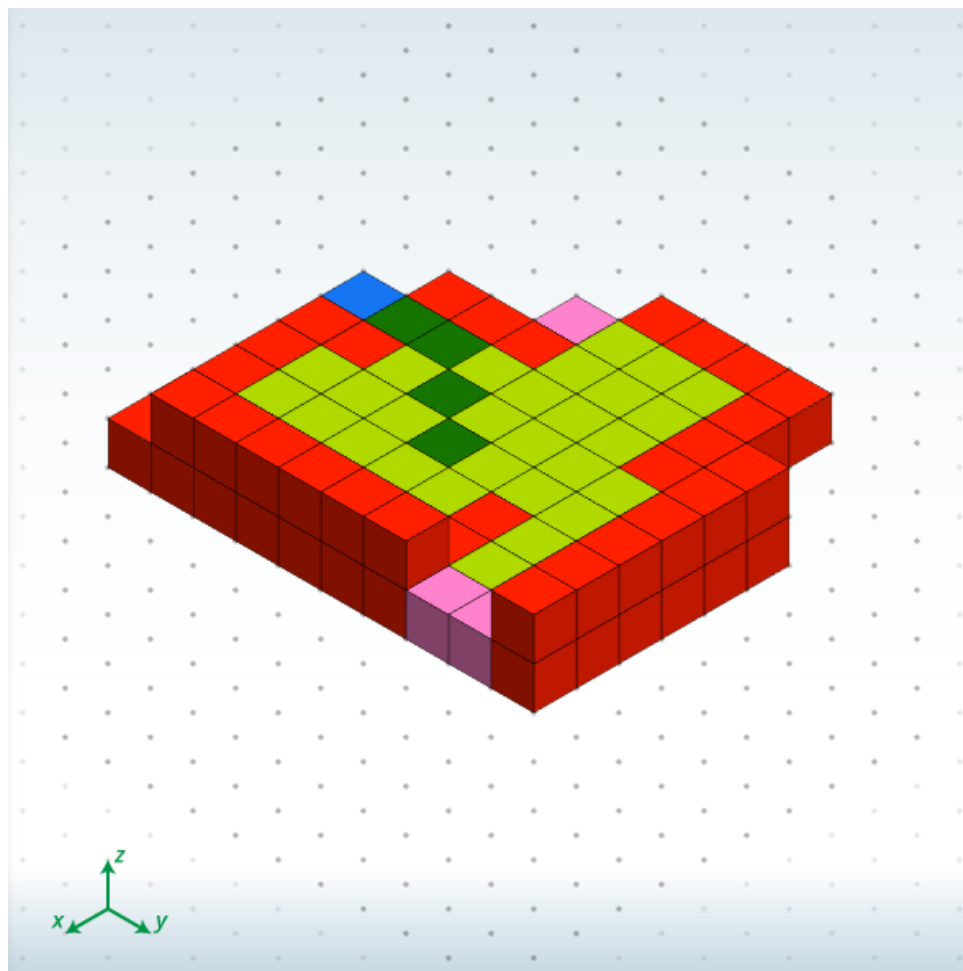
Our mapping algorithm



Our mapping algorithm



Our mapping algorithm



Conclusion

- This approach is designed for buildings with standard rooms and spaces.
- Probably not optimal for caves and mines.
- Low-cost drones are not suitable for this.
- Limitations could be:
 - stairs material,
 - mirrors and glass.



Future

- Implement our algorithm into the real drone architecture.
- Optimize path planning between unknown cells.
- Add object classification to our mapping process.





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