

Evaluation of AI-based Drone Assistive Automation Systems in Search and Rescue Missions in a Simulated Environment

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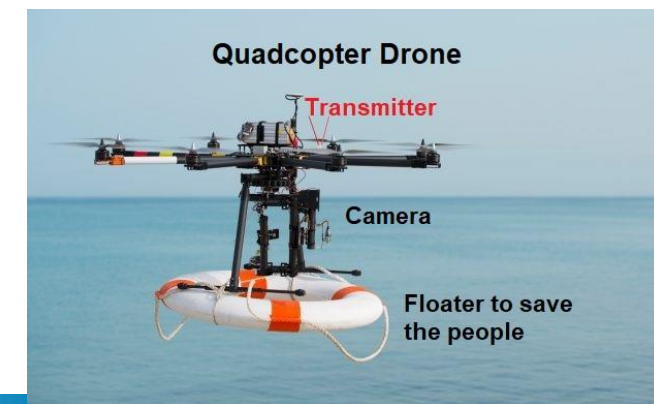
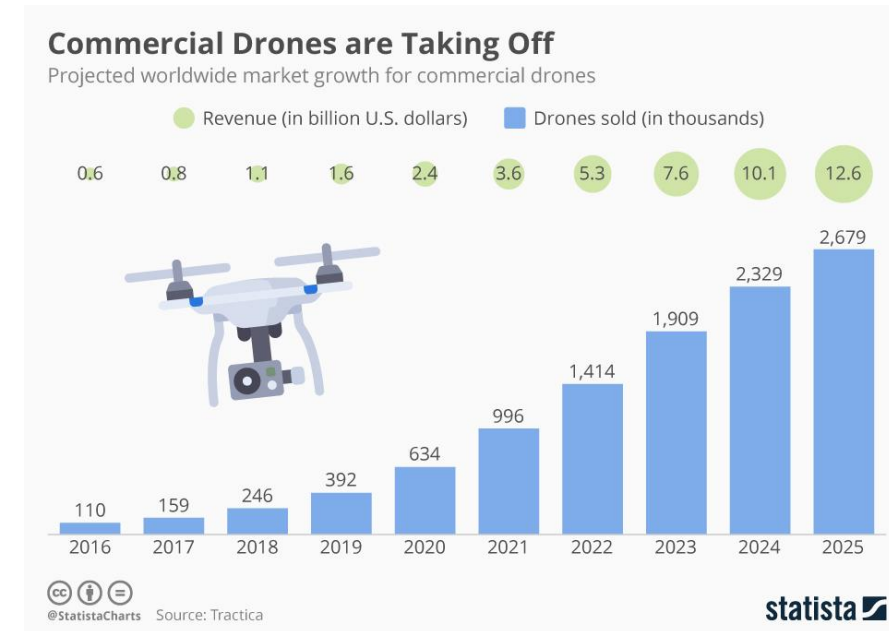
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1. Significance of Drone AI in Search and Rescue

- Drones have become widely available
 - Steady growth in the drone market
 - Approximately 850,000 drones registered in US (FAA)
- Drones are being used for videography, delivery, weather monitoring, and search and rescue (SAR)



1. Significance of Drone AI in SAR

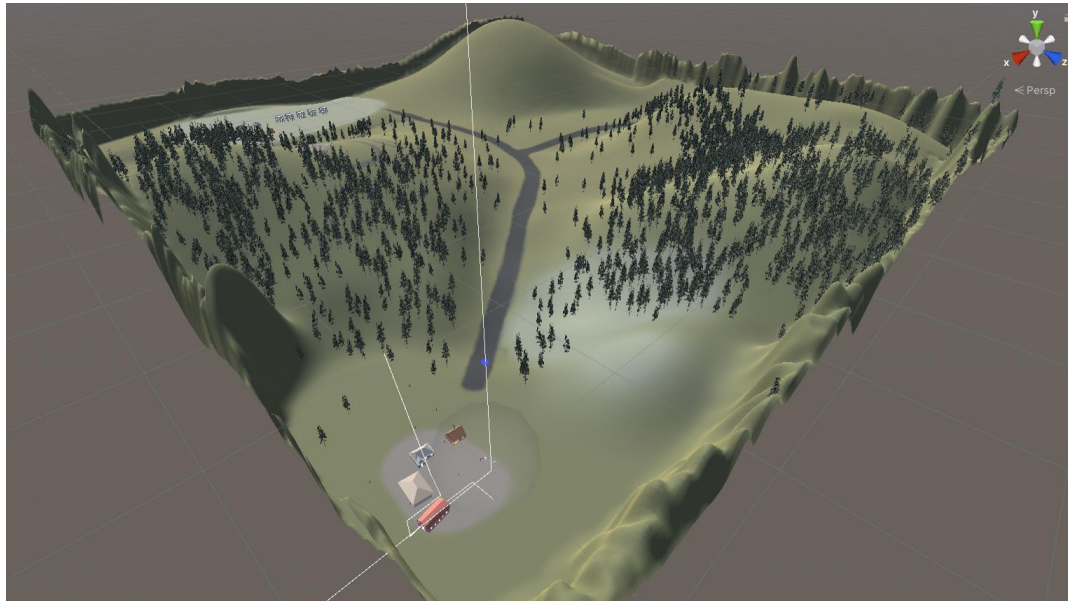


- The goal of search and rescue (SAR) is to locate and extract individuals in distress
 - A drone can facilitate SAR by taking the “search” task
- Consequently, Drone AI can
 - relocate the human agents’ focus to the “rescue” side of SAR
 - Increase their situational awareness with environmental data from the drone
 - Assist their decision making with more information available

1. Significance of Drone AI in SAR

- The key components of an effective drone AI are:
 - Efficient search strategy
 - Reliable detection method
 - Proper decision making
 - Effective communication
- The current stage is at developing an efficient searching method

2. Simulation



Simulation Environment

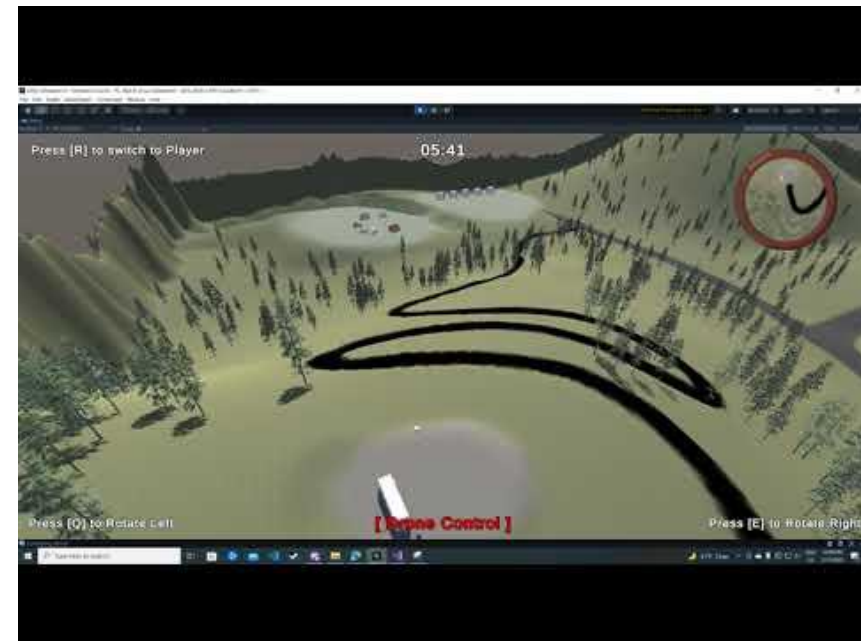


Player View



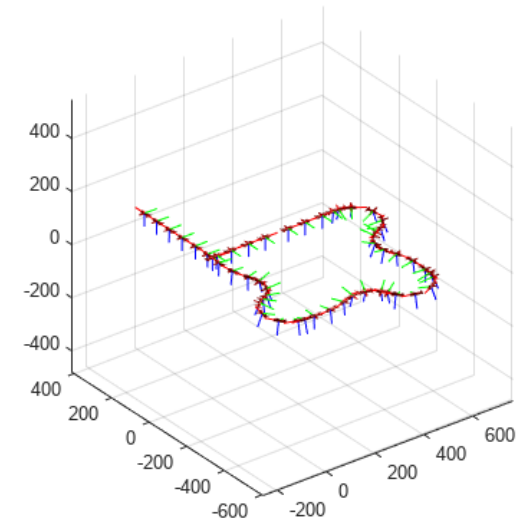
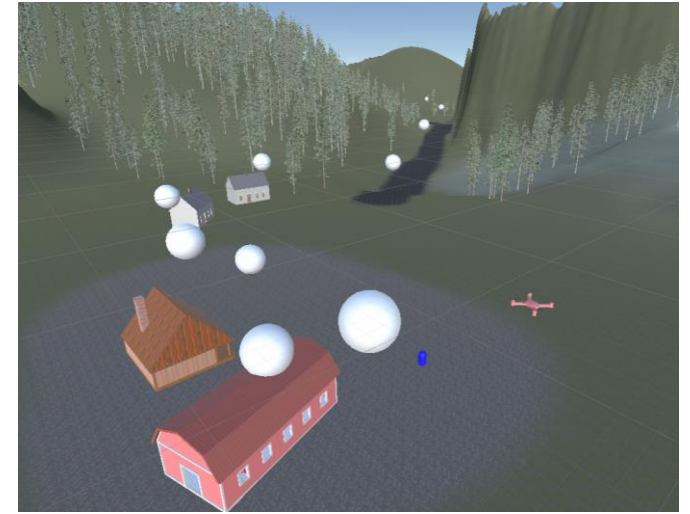
Drone View

2. Simulation: Demonstration



3. Search Strategy

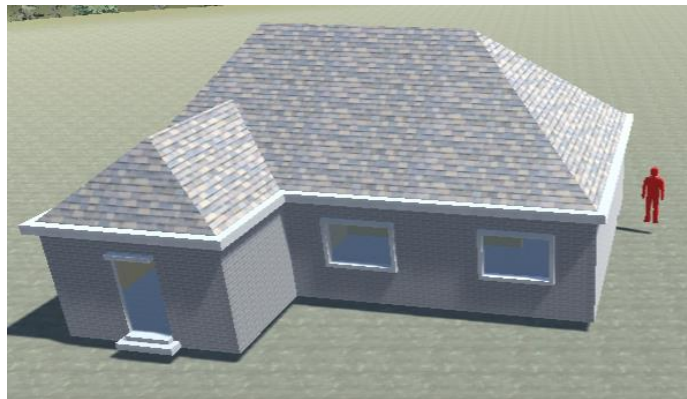
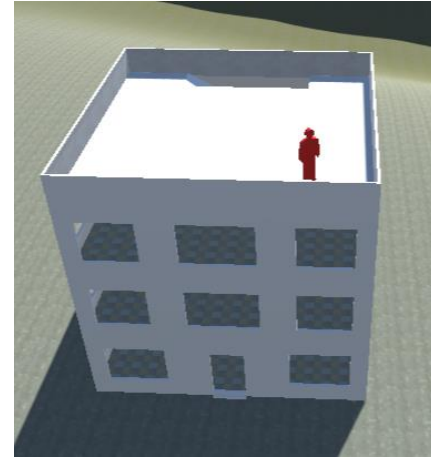
- Currently, the drone follows a pre-planned path
 - No complexity or strategy
- Search algorithms are being assessed
 - For the most efficient search path
- Speculatively, uninformed/blind search algorithms would be ineffective and inefficient
 - Depth First Search, Breadth First Search, Uniform Cost Search, etc.
 - The search space is a mostly empty 3D space
 - Thus, heuristic search would be ideal for SAR



3. Search Strategy

- Search Priorities

- Regions that are difficult to search from the ground
- Prominent places that hostages could be hiding
- Areas that are too dangerous for human agents to traverse through

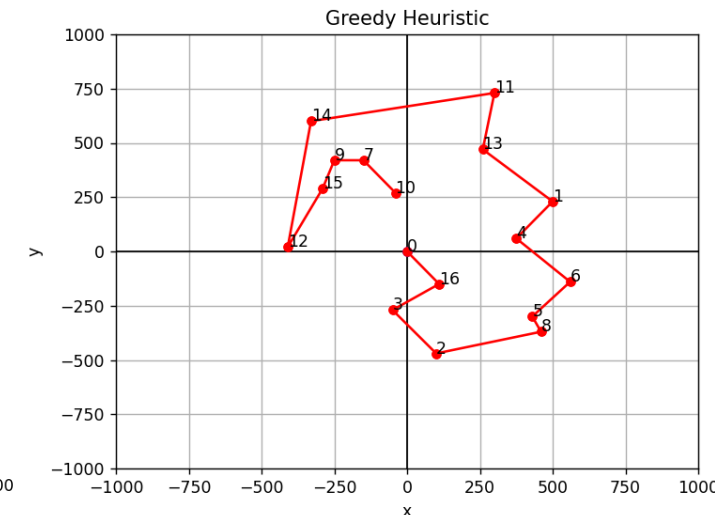
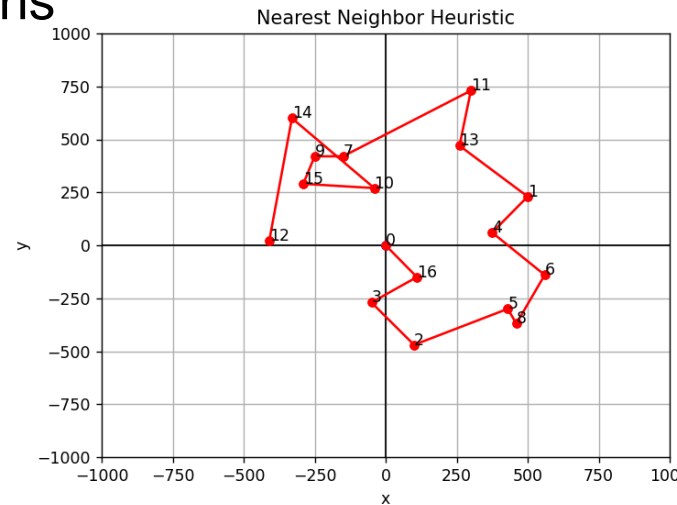
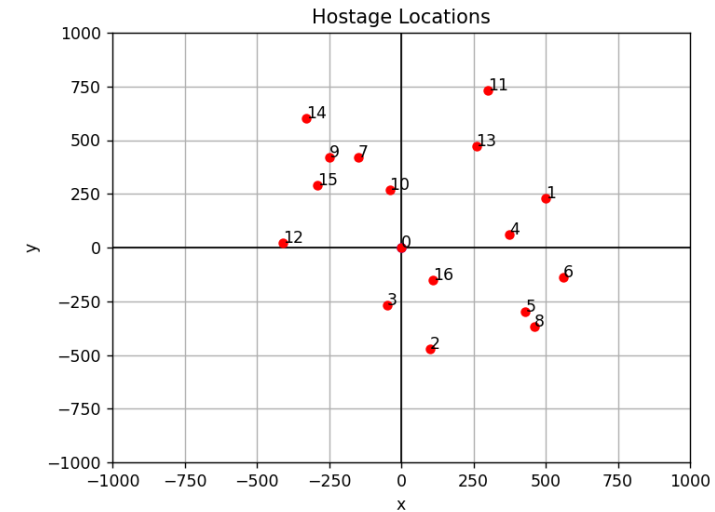


4. Drone Reliability Questions

- Does the drone search efficiently?
 - Compare different searching methods to evaluate their performances
- Does the drone correctly detect the hostages?
 - Train and test the detection model with different configurations and image dataset
- Does the drone help the human agent?
 - Is the drone actually useful?

5. Evaluation: Path Analysis

- Compare human players' paths to suboptimal paths
- Each path can be evaluated based on the:
 - Closeness to the suboptimal paths
 - Total path distance



6. Conclusion

- This is an ongoing study. Further implementation and evaluation are necessary
- Proving the reliability of the AI-based drone assistive automation system in the simulation can indicate its potential impact as a real-world application

References

- [Unity Simulation Environment Progress – YouTube](#) progress playlist
- [Drones by the Numbers \(faa.gov\)](#)
- [Chart: Commercial Drones are Taking Off | Statista](#)
- [Classification and Application of Drones · CFD Flow Engineering](#) rescue drone picture
- [12 Best Uses of Drones - 3D Insider](#) drone camera picture
- [Regulating Domestic Drone Use | The Regulatory Review \(theregreview.org\)](#) drone delivery picture
- [Drones for search & rescue missions – AltiGator](#) SAR drone picture

Thank you!

