Development of a UAV-based Disaster Evacuation Support System: an Interim Report

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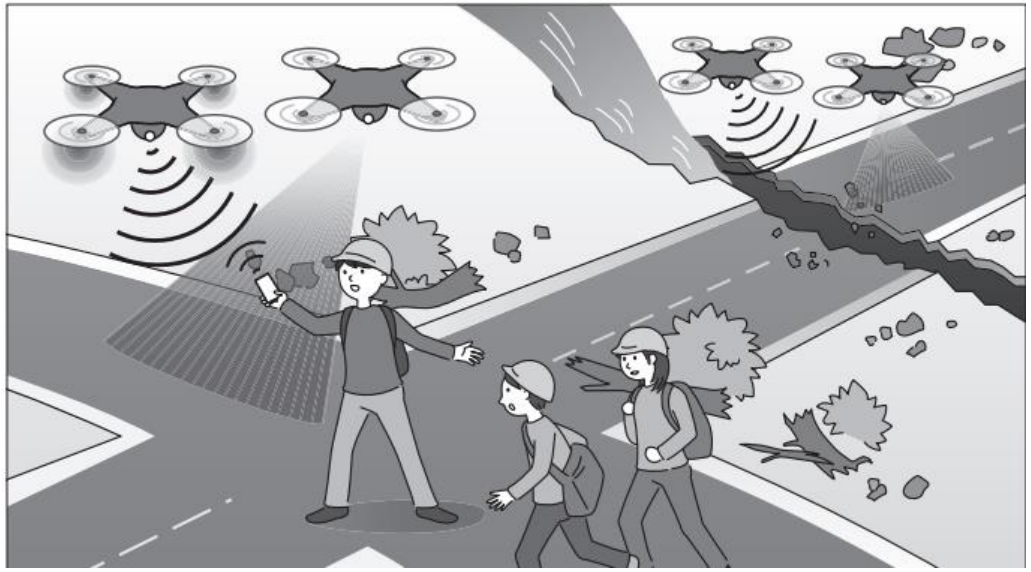
Biography

Yuta Sekiguchi received his B.S. degree in Information Technology and Media Design from Nippon Institute of Technology in 2023. Since the same year, he has been a master's student in the Department of Electronics and Information Media at Nippon Institute of Technology. His research focuses on swarm robots.

Background

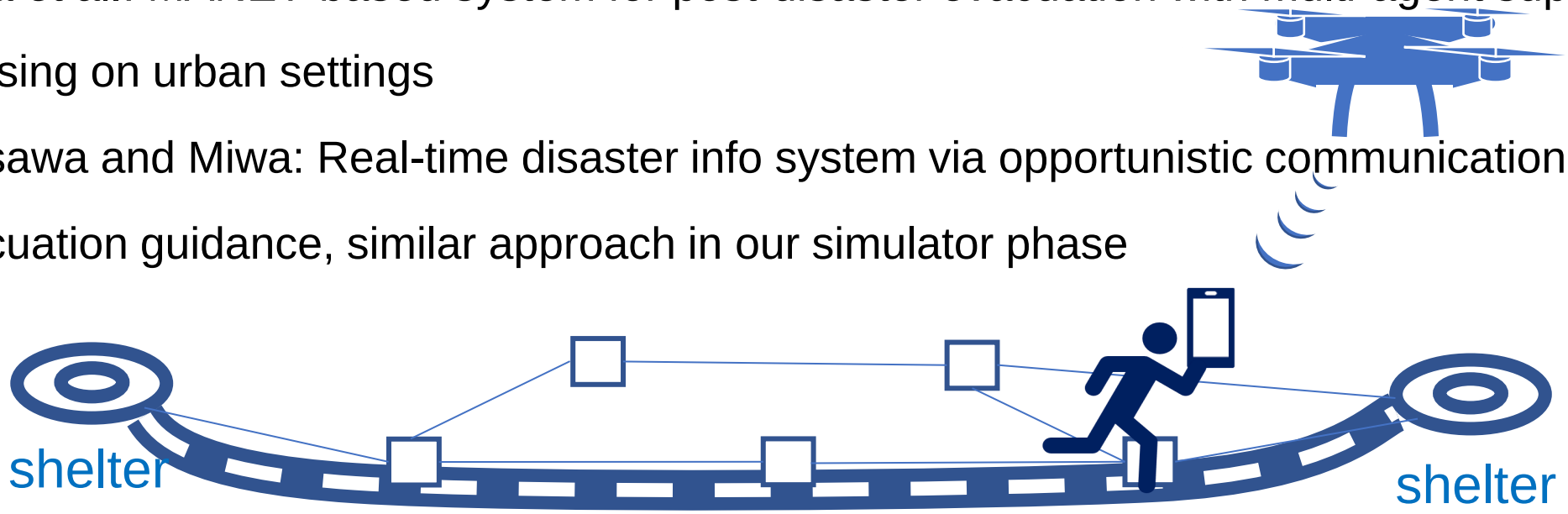
- Japan faces a wide range of disasters, making rescue operations in remote and mountainous areas particularly challenging.
- UAVs (Unmanned Aerial Vehicles) play a crucial role in locating and guiding disaster victims.
- In anticipation of communication infrastructure failures, UAVs form an ad-hoc network (ANET) to maintain connectivity and coordination.



Related Research

Studies on evacuation support systems using mobile terminals and UAVs

- Katayama et al.: Agent-based UAV system integrating IoT for disaster monitoring and optimal evacuation routes, avoiding tsunami areas
- Taga et al.: MANET-based system for post-disaster evacuation with multi-agent support, focusing on urban settings
- Fujisawa and Miwa: Real-time disaster info system via opportunistic communication for evacuation guidance, similar approach in our simulator phase



Related Research

Tago et al.(2020)

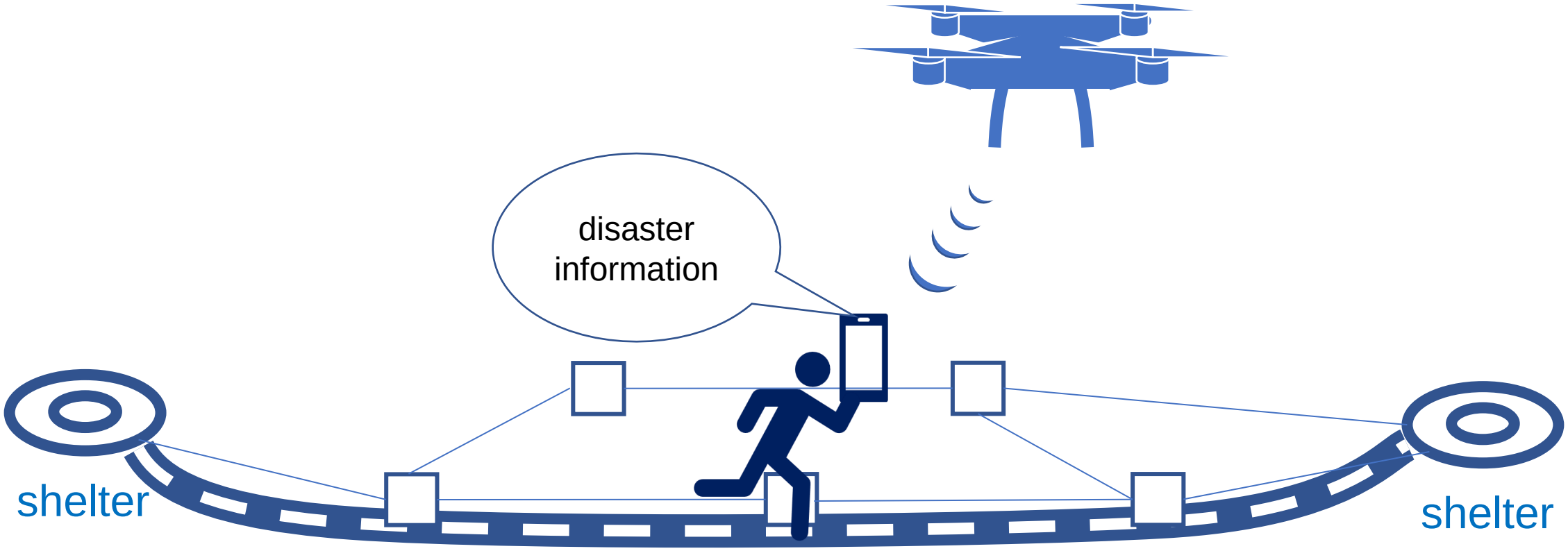
Evacuation guidance considering priority in mountainous areas

Forming an ad hoc communication network through UAVs communication

- Validation in a simple simulation environment
- In the simulation, 20% were unable to evacuate.

Survey of people who have difficulty evacuating
Implementation of practical evacuation support systems

Evacuation Support System



Evacuation Support System

Priority

- Numerical values used to determine priorities
- Definition : $priprity = \alpha A + \beta B + \gamma C + \delta D$

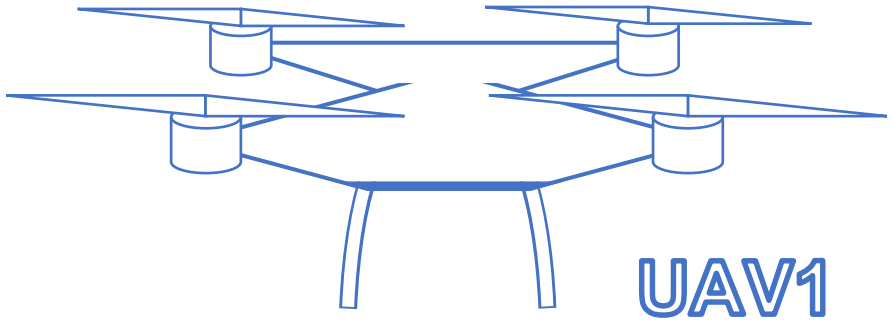
Arbitrary coefficient: α,β,γ,δ
A: Distance
B: Time required
C: Number of victims
D: Possibility of secondary disaster

Operational Environment

Points and corridors where UAVs navigate

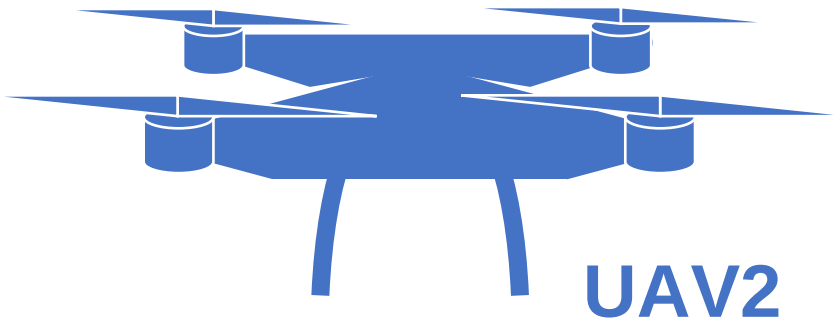
Example of point and passage

Role of UAVs



For information gathering

- Search for evacuees
- Receive information from UAVs
- Update priority



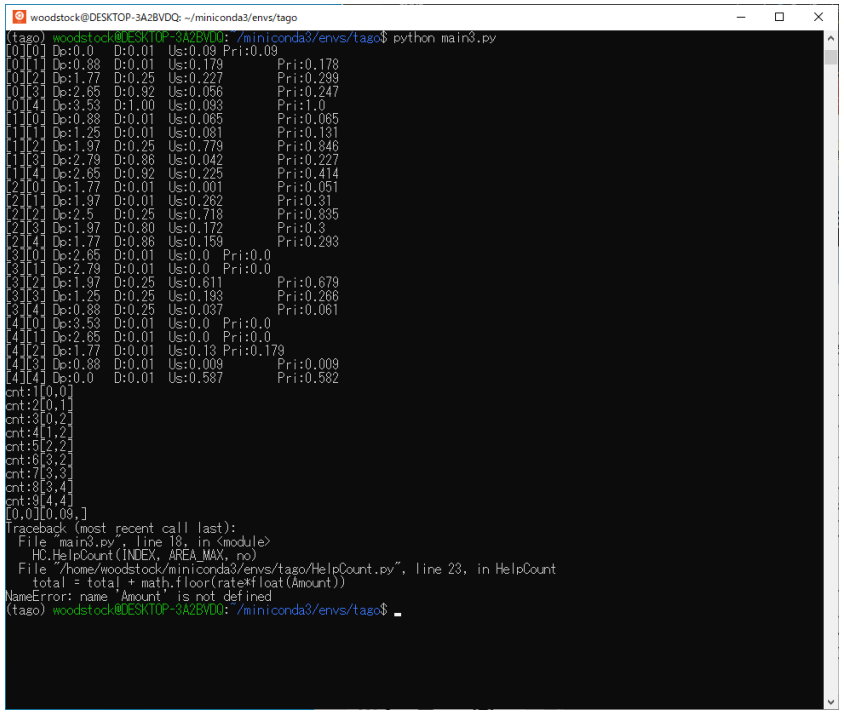
For Evacuation guidance

- Search for evacuees
- Guide evacuees

simulator

Change of display and operation system

CUI(Character User Interface)



GUI (Graphical User Interface)

Unity2020.3.27f1

Execution Result

future work

Implement autonomous behavior of disaster victims

- Apply distributed multi-agent framework to simulate behavior while unguided.

Alejandro et al.(2014) Distributed Evacuation Route Planning Using Mobile Agents

Conclusion

Development of Disaster Evacuation Support System Using UAVs

- Design of a system specialized for mountainous regions
- Introduction of two types of UAVs for scenarios with communication infrastructure failure during disasters

Visualization of UAV and Evacuee Movement History on Maps

- Demonstration of simulation understandable even to non-experts
- Observation of the process of human guidance

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