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Project Proposal

We are proposing a distributed distance-optimization algorithm to deploy network nodes using drones, enabling the expansion of wireless coverage from a central transceiving station across a large disaster-affected area. The drones autonomously navigate and position themselves to ensure optimal signal distribution, guided by real-time data such as signal strength, battery levels, and environmental obstacles. This system operates as a multi-agent system (MAS), where each drone acts as an intelligent agent capable of independent decision-making.

To enhance functionality, the drones can be equipped with RF detection capabilities to identify radio-emitting devices like smartphones or Bluetooth-enabled gadgets, aiding in the detection of human presence during search-and-rescue missions.

In situations where battery limitations arise, the drones calculate and communicate precise, optimized locations to ground-based relay vehicles. Using 3D environment mapping, the drones assess terrain feasibility and construct viable paths for the relay vehicles. These ground vehicles then navigate to the designated locations and station themselves, ensuring uninterrupted network connectivity.

This approach, combining autonomous drone deployment, multi-agent coordination, and 3D mapping, is particularly well-suited for disaster response and recovery operations, where rapid and reliable network establishment is critical.

Sai:

As for the environment we could use the one provided in the PA1, the grid, where we can represent disaster blockages using red color and the signals using blue colors, as per the battery level of the drone. Let’s say a drone has full battery, the coverage could be shown as a 5x5 blue shape. and another drone has a battery health of 75%, the coverage goes down to 4x4 shape. if a drone’s health goes really low, then a substitute vehicles is requested and a path for it is marked on the map. The drones also analyze the number of users in an area and position accordingly to accommodate everyone. every now and then the drones do a random sweep to identify if there’s more users.