ABSTRACT

Disaster relief operation is often executed post-disaster In order to minimize loss and victims. In disaster relief, time is a huge constraint since it is related to people's lives and loss. Especially after a disaster happened, searching for survivors become crucial in order to minimize victims. However, sometimes infrastructure becomes unavailable post-disaster or the environment is unsafe for people to look for survivors. To overcome this problem, unmanned aerial vehicle (UAV) is often deployed. Despite being a disaster-prone country, UAV has not been used much in Indonesian disaster relief and operation.

Regardless of UAV's ability to perform a disaster relief operation, UAV has a limited energy capacity. In order to perform such tasks, UAV has to be deployed along with ground vehicle (GV) to ensure UAV able to charge or swap battery during its mission. Thus, the coordination of UAV and GV is important to complete this mission. This research focuses on the routing problem model development for unmanned aerial vehicle and ground vehicle. This research also implements the model to the 2010 Merapi eruption, one of the volcano eruption in Indonesia.

The algorithm of this research adapted the depth-first search (DFS) algorithm because of its ability to search for possible paths and 'backtrack' when adjacent node is unavailable. To represent the environment, this research uses a time-space network. To ensure the model works, the model is implemented in the small-scale case by creating 9 random target nodes (node that has to be visited by UAV) and 4 random optional rendezvous node (optional stopping node for GV). The algorithm is solved using Jupyter Notebook with Python as its programming language. The result shows that UAV able to cover all of target nodes with 3 nodes used out of 4 optional rendezvous node. This route is already verified with GV, ensuring that GV is able to access the UAV route.

After the model is verified, the model is implemented into scaled-up case, the 2010 Merapi eruption. Nodes for this research are obtained from the 2010 Merapi eruption, where target nodes are the affected area during the eruption and optional rendezvous node. There are 13 target nodes and 5 optional rendezvous node. The result shows that UAV able to cover all of target nodes with 4 nodes used out of 5 optional rendezvous node.

Keywords: disaster relief operation, unmanned aerial vehicle, ground vehicle, routing problem, depth-first search, time-space network