ABSTRACT

With the rapid advancement of wireless communication, sensors, and battery technologies, Swarm Unmanned Aerial Vehicles (UAVs) have been widely used recently to track air pollution, traffic surveillance, and military application. Swarm UAVs, however, need to plan paths through the atmosphere, effectively preventing any collision that can occur when flying a multiple UAV simultaneously. This study proposes to design an anti-collision among UAVs and a path planning system of swarm UAVs by using Artificial Bee Colony (ABC) algorithm.

The ABC algorithm is an optimization method inspired by the foraging behavior of honeybees. Inside their colonies, they have different roles for their labors, including employed bees, onlooker bees, and scout bees. The self-organization trait of honeybees enables them to coordinate themselves to create a global and local optimum. The proposed system, however, uses the ABC algorithm to optimize UAV's velocity, i.e., to reach its destination efficiently in the shortest path while avoiding collision among drones. The establishment of a constraint of a minimum acceptable distance among UAVs enables the algorithm to search for an alternative path in avoiding a collision.

The simulation, however, reveals a successful convergence of a swarm UAVs towards a destination with no collision. During the trial with 12 and 20 drones, for instance, all UAVs successfully arrive at their goals with 0 potential collisions. However, during the test with 50 drones, there are 12 possible collisions. Once swarm drones reach their goal position at rest, the cluster will not overlap with other agents, as demonstrated in the visualization. Therefore, the ABC algorithm has satisfied the success criteria for this project and is suitable for swarm drone applications.

Keywords: ABC Algorithm, Collision Avoidance, Swarm UAV, Path Planning