

IISc team bats for drone swarms to tackle forest fires, other disasters

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Bengaluru: A new approach by Indian Institute of Science researchers seeks to use multiple swarms of drones to tackle natural disasters like forest fires, which are becoming increasingly catastrophic across the world, accelerated by climate change.

“A swarm of drones could be the solution,” said Suresh Sundaram, professor at IISc’s department of aerospace engineering (DAE). Although they haven’t yet been used in India, use of drones is not entirely new. In the study, Sundaram’s team proposes taking the technology a step further: Coordinated multi-swarm drones swooping in to quell forest fires.

“By the time somebody identifies and reports a fire, it has already started spreading and cannot be put out with one drone. You need to have a swarm of them; a swarm that can communicate with each other,” Sundaram said.

The solution was to design a special algorithm that would allow the swarm to communicate as well as make independent decisions. The closest drone becomes the centre of the swarm and attracts others towards it. Each drone will also have the freedom to calculate the fire’s size and potential spread, and decide how many are needed to douse the flames.

“These decisions are made by drones. They figure out which cluster of fire is going to spread faster and allocate the required number of drones to put out that fire while others look for other clusters,” Sundaram explained.

The swarm-based search algorithm developed by the team is key to controlling drones' behaviour, IISc said, adding that searching for fire cannot be random as the area to explore would be too large. To address this, researchers took inspiration from foraging behaviour of a marine predator, a flagellum called *Oxyrrhis marina*.

"When foraging, it first takes longer steps to explore the area. Once it feels like it is closer to the food source, it'll reduce step length and start exploring the area in more detail," explained Josy John, PhD student at DAE, and lead author of the study published in IEEE Transactions on Systems, Man, and Cybernetics: Systems.

The team decided to incorporate this behaviour into their algorithm. "Temperature sensors in drones look for a minimum [threshold] value. Upon reaching that, they reduce their search step, because the fire is near," John added.

Sundaram said advantages of using drones are: Decision-making is decentralised, based on data, and aimed at maximum efficiency. "No more than the required number of drones will be assigned to a fire cluster, allowing others to fan out in search of other clusters."

"Full-scale search and mitigation by the swarm is yet to undergo field-testing. Going forward, the team plans to combine such drone swarms with unmanned ground vehicles that can carry resources and serve as refuelling stations. Such drone swarms can also be helpful during natural disasters like floods and earthquakes — to locate survivors, deliver water, food and medicines and boost communication," IISc said.