#06 EcoSense EMBER

Global temperatures have been consistently increasing over the last decades, causing bushfires to become more frequent and destructive. In 2019, 21% of Australia's forested area was destroyed by wildfires, releasing significant amounts of greenhouse gases, destroying homes and decimating the habitat of local fauna (Biddle et al.). Fighting these fires is not only expensive and dangerous, but often fruitless as wildfires quickly develop to a stage where they are too large to control. The early detection of developing fires is therefore imperative to preventing them, but often infeasible as they start in remote natural reserves that are hard to reach by humans. Detection methods such as aerial surveillance or satellite imaging exist, but are temporally sparse, expensive or can only detect fires when they have grown significantly. As such, a need exists to detect fires in hard-to-reach environments at an early stage such that they can prevented effectively.

Mission Objective

EcoSense EMBER (Environmental Monitoring of Bushfires for Early Response) aims to fulfil this need, leading to the following mission need statement:

Mission Need Statement

Gathering spatially- and temporally-dense datasets in hard-to-reach environments for early fire detection.

This need is fulfilled by deploying a network of fire-detecting sensor nodes. The network is deployed by an unmanned aerial vehicle, allowing the operator to easily deploy the system in hard-to-reach environments such as national parks. This mission is specifically aimed at the Wollemi, Yengo and Blue Mountains national park, which is located North-West of Sydney, Australia. The network would be deployed in this park, and used to detect forest fires in early stages of growth.

System Design

EMBER composes of two parts: the deployment vehicle and the sensor network. The deployment vehicle is a non-rigid unmanned airship, powered by solar power only. This airship or blimp operates autonomously and is designed to deploy the network without human interference. Once deployed, the blimp returns to the ground station. At the point of writing, the subsystems of this blimp have been developed and are being merged into a comprehensive design.

The sensor network consists of sensing and relay nodes. The sensing nodes detect fires by using carbon monoxide and hydrogen gas sensors, which indicate the presence of early smouldering fires. Once detected, the alert is passed via relay nodes to the ground station, in which case a response by local firefighters is triggered. Through the combination of these two systems, a viable solution for early fire detection in remote areas is created.