Using Remote Sensing for Wildfire Detection and Monitoring

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With the increasing availability of remote sensing, it has become a very popular and efficient way of detecting and monitoring wildfires. UAV's equipped with the right sensors are able to easily pinpoint wildfires across a vast area. This allows firefighters to respond to the disturbance in a timely manor.
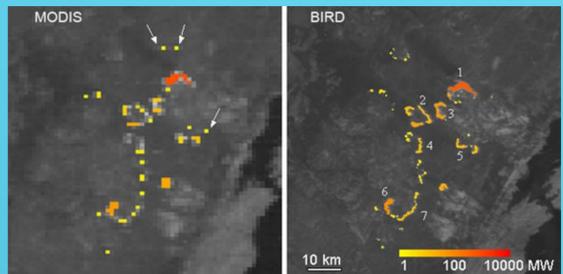

Figure 1: Shows forest fire intensity and distribution with thermal sensors. (http://www.directionsmag.com/entry/detection-and-monitoring-of-wildfires-by-a-constellation-of-small-sate/275753)
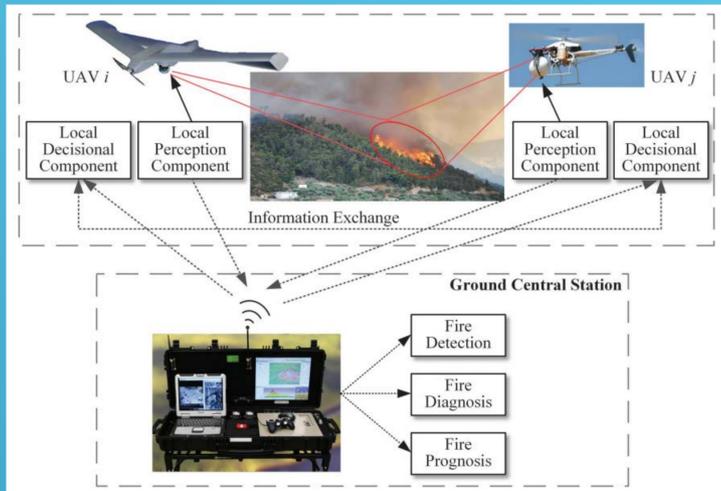

Figure 2: Represents how UAV's are used to identify and report wildfires back to local fire stations. (http://eds.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=06720250-cb65-4dfe-a781-7f8fff4ffb01%40sessionmgr4010&vid=1&hid=4203)

Remote sensing techniques can be placed into three different categories: Satellite-based systems, ground-based systems, and manned aerial vehicles. Unfortunately, each of these techniques comes with its own set of issues (Den Breejen et al. 1998). It is much harder to adjust the path of Satellite-based systems and it can be difficult if not impossible to do any repairs or updates. Ground-based systems are much easier to make repairs and apply updates to but their low range makes them somewhat inefficient. Aerial vehicles can be a great technique for remote sensing but the steep prices can be very limiting for certain companies.

Certain satellites such as the Greenhouse Gas Observing Satellite (GOSAT) detect wildfires by the output of smoke rather than the flame itself (Allison, Robert *et al.*, 2016). This is important because you can gather other valuable information from this rather than just fire temperature. Chemicals can be detected through the smoke and this can sometimes give you an idea of what is actually burning, such as houses or anything else that might be engulfed in a massive forest fire. In the middle of the day, smoke is the most obvious sign of a fire, rather than the flames themselves, so this technique proves to be very effective.

Figure 3: Smoke is sometimes the easiest way to spot fires, especially in broad daylight. (https://www.adn.com/alaska-news/2016/07/17/25-acre-fire-near-mchugh-creek-sends-smoke-plume-over-cook-inlet/)

Another interesting technique for wildfire management being used by MODIS bands is monitoring vegetation in arid environments (Jacques *et al.*, 2014). This method identifies areas that are extremely arid by using short wave infrared bands for detecting any moisture in the vegetation. Short wave infrared is absorbed heavily by water so any plants that have a high amount of water content should show very low reflectance values in SWIR, when SWIR reflectance values are high in vegetation, it means the vegetation is very dry and susceptible to wildfire.

MODIS has many different applications other than monitoring water content in vegetation. A receiving station in Missoula, MT, uses MODIS for monitoring burned areas across the western United States (Urbanski, 2009). This is used to access the effects of wildfire on air pollution. This just goes to show how versatile and effective MODIS can be.

Figure 4: MODIS can be very useful for detecting burned areas such as in the figure above for estimating air pollution. (http://forobs.jrc.ec.europa.eu/products/burnt_areas_gba2000/global2000.php)

Conclusion

Remote sensing offers a variety of ways to monitor and detect wildfires across the globe. Some methods are more effective than others but that usually comes with a cost. Satellites and other UAV's usually come with a fairly steep price while ground-based systems are usually cheaper but can't monitor nearly as big of an area. In the end, certain methods are better than others depending on the scenario. One thing is for certain however, as remote sensing becomes more and more relevant in our everyday lives, these methods and techniques will continue to improve over the years.

References

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