

Literature Survey

Emerging Methods for Early Detection of Forest Fires

1) Emerging Methods for Early Detection of Forest Fires Using Unmanned Aerial Vehicles and Local Sensor Networks

Authors: G.V. Hristov, Jordan Raychev, Diyana Kyuchukova

In this paper we have briefly presented two new methods for early forest fire detection, including part of their characteristics and main components. We have also analysed some of the benefits, which these methods can provide to the involved Bachelor, Master and PhD students. Both solutions are still under development, but they show great potential and work on their development and improvement will continue in the following years.

REFERENCES

- [1] Official webpage of the European Forest Fire Information System at: <http://effis.jrc.ec.europa.eu/>
- [2] Official webpage of the Copernicus Earth Observation Programme at: <http://www.copernicus.eu>
- [3] Forest Fires in Europe, Middle East and North Africa 2016, JRC Science for policy report, BN 978-92-79-71292-0, ISSN 1831-9424, doi:10.2760/17690, available at: http://effis.jrc.ec.europa.eu/media/cms_page_media/40/Forest_fires_in_Europe_Middle_east_and_North_Africa_2016_final_pdf_JZU7HeL.pdf
- [4] The 2018 Attica wildfires Wikipedia webpage available at: https://en.wikipedia.org/wiki/2018_Attica_wildfires

[5] László Földi and Rajmund Kuti, Characteristics of Forest Fires and their Impact on the Environment, Academic and Applied Research in Military and Public Management Science (AARMS), Vol. 15, No. 1, 2016, pp. 5–17, ISSN 2064-0021;

[6] <https://www.firedex.com>

[7] Wolfgang Jendsch, Aerial Firefighting, Schiffer Publishing, 352 pp, ISBN 9780764330681

[8] Chi Yuan, Youmin Zhang and Zhixiang Liu, A Survey on Technologies for Automatic Forest Fire Monitoring, Detection and Fighting Using UAVs and Remote Sensing Techniques, Canadian Journal of Forest Research, doi: 10.1139/cjfr-2014-0347

[9] W. Krüll, R. Tobera, I. Willms, H. Essen and N. V. Wahl, Early Forest Fire Detection and Verification Using Optical Smoke, Gas and Microwave Sensors, Procedia Engineering vol. 45, pp. 584-594, 2012

[10] Project SFEDA page at: <http://www.interreg-balkanmed.eu/approved-project/22/>

[11] V. C. Moulianitis, G. Thanellas, N. Xanthopoulos, N. A. Aspragathos, Evaluation of UAV based schemes for forest fire monitoring, 27th International Conference on Robotics in Alpe-Adria-Danube Region, RAAD 2018

[12] Official webpage of the Alti Transition VTOL UAV at: <https://www.altiuas.com/transition/>

[13] Official webpage of the DJI Matrices 600 Pro UAV at: <https://www.dji.com/matrice600-pro>

[14] Official webpage of the DJI Matrices 200 series of UAVs at: <https://www.dji.com/matrice-200-series>

[15] Official webpage of Modius at: <https://www.movidius.com>

[16] Official webpage of the IMST iC880A Lora WAN concentrator at: <https://wireless-solutions.de/products/long-range-radio/ic880a.html>

2) Forest Fire Modelling and Early Detection using Wireless Sensor Networks

Author: Mohamed Hefeeda and Majid Bagheri

We conducted extensive simulation study to validate our theoretical analysis and to compare our coverage algorithms against others in the literature. The comparisons showed that our algorithms outperform other algorithms along several performance metrics, including convergence time, number of sensors activated, and total energy consumption. Furthermore, our simulations show that our distributed algorithm: (i) balances load across all deployed nodes, and therefore maintains reliable coverage and significantly prolongs the network lifetime; and (ii) can provide various coverage degrees at different areas of the forest, and thus can achieve higher detection accuracy in important areas such as near residential or industrial neighbourhoods.

REFERENCES

- [1] Z. Abrams, A. Goel and S. Plotkin. Set k-cover algorithms for energy efficient monitoring in wireless sensor networks. In Proc. of International Symposium on Information Processing in Sensor Networks (IPSN'04), Berkeley, CA, April 2004, pp. 424–432.
- [2] Aero vision Web Page. <http://www.aerovision-uav.com>.
- [3] N. Ahmed, S. Kan here and S. Jha. Probabilistic coverage in wireless sensor networks. In Proc. of IEEE Conference on Local Computer Networks (LCN'05), Sydney, Australia, November 2005, pp. 672–681.

[4] I.F. Akyildiz, S. Weilian, Y. Sankarasubramaniam and E. Cayirci. A survey on sensor networks. IEEE Communications Magazine 40(8) (2002), 102–114.

[5] M.E. Alexander and W.J. De Groot. Fire behavior in Jack Pine stands as related to the Canadian Forest Fire Weather Index System. Technical report, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta, 1988.

[6] AVHRR Web Page. <http://noaasis.noaa.gov/noaasis/ml/avhrr.html>.

[7] B.C. Ministry of Forests and Range. Fire Review Summary for Okanagan Mountain Fire (K50628).

[8] B.C. Ministry of Forests and Range Web Page. <http://www.for.gov.bc.ca>.

[9] E. Breejen, M. Breuers, F. Cremer, R.A.W Kemp, M. Roos, K. Schutte and J.S. Vries. Autonomous forest fire detection. In Proc. of Third International Conference on Forest Fire Research and Fourteenth Conference on Fire and Forest Meteorology, Luso, Portugal, November 1998, pp. 2003–2012.

[10] H. Bronnimann and M. Goodrich. Almost optimal set covers in finite VC-dimension. Discrete and Computational Geometry 14(4) (1995), 463–479

[11] Canadian Forest Fire Danger Rating System (CFFDRS) Web Page. <http://www.nofc.forestry.ca/fire>.

[12] Canadian Forest Service (CFS) Web Page. <http://www.nrcan.gc.ca/cfs>.

[13] Q. Cao, T. Yan, T. Abdelzaher and J. Stankovic. Analysis of target detection performance for wireless sensor networks. In Proc. of International Conference on Distributed Computing in Sensor Networks, Marina Del Rey, CA, June 2005, pp. 276–292.

[14] M. Cardei and J. Wu. Coverage in wireless sensor networks. In M. Ilyas and I. Mahgoub, editors, Handbook of Sensor Networks. CRC Press, 2004.

[15] M. Cardei and J.Wu. Energy-efficient coverage problems in wireless ad hoc sensor networks. Elsevier Computer Communications 29(4) (2006), 413–420.

Submitted by:

V.Jayanth

S.Sham

J.Aswathaman

U.Gokul