International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

REAL-TIME MULTI- SENSOR FIRE DETECTION SYSTEM USING FIRE FIGHTING ROBOT

Ahamed Riyaz[1], Goutham Kumar[2], Gowtham[3], Joel Kirubakaran[4], Anandselvakarthik[5]

[1-4]Student, Department of ECE, Hindusthan College of Engineering and Technology, Coimbatore, Tamilnadu
[5]Professor, Department of ECE, Hindusthan College of Engineering and Technology, Coimbatore, Tamilnadu

---

Abstract - *Fire is a phenomenon combustion manifested in light, flame, and heat. There are three main elements required for fire to exist, these are; oxygen, heat and fuel. These make up what is known as the **fire triangle**. The proportion of each of these elements determines the nature of the fire. With fire and some of its byproducts being employed in a lot of useful applications such as cooking, power generation and the manufacturing process, among others, it has the potential to also cause havoc. A fire alarm system has a number of devices working together to detect and warn people through visual and audio appliances when smoke, fire, carbon monoxide or other emergencies are present. These alarms may be activated automatically from smoke detectors and heat detectors or may also be activated via manual fire alarm activation devices such as manual call points or pull stations. Alarms can be either motorized bells or wall mountable sounders or horns. They can also be speaker strobes which sound an alarm, followed by a voice evacuation message which warns people inside the building not to use the elevators.Conventional fire alarms are based on smoke detection. Nevertheless, in some fire scenarios volatiles are released before smoke. Fire detectors based only on chemical sensors have already been proposed as they may provide faster response. These systems rely heavily on pattern recognition techniques to discriminate fires from nuisances. The problem is further compounded by the lack of adequate alert and notification mechanisms. A typical system relies on the physical presence of a human being to act on the alert. To address this problem an advanced system was implemented using an Arduino development board with inputs from the sensors are implemented and along with the fire fighting which is manually or automatically controlled.*

1. INTRODUCTION

Wildfires, mainly caused by humans, have been on the rise in recent decades. According to researchers global warming is suspected to have contributed to the intensity and the frequency of these fires by making forests drier and more likely to burn. This trend is not expected to change in the years to come. Reaching a wildfire early is crucial for increasing the probability that a small and manageable fire will not become large and unmanageable. The key advantage of aircraft in wildfire fighting is their speed and their ability to access remote or otherwise difficult-to-reach fires. At the same time, present-day aerial firefighting is expensive, hazardous for the flight crews, and suffers from many limitations such as inability to operate at night. Autonomous UAVs are potentially more efficient in terms of safety, cost and payload (there is no pilot and there is no cockpit). In addition, UAVs are not restricted from operating at night time or in bad weather. UAVs have recently begun to be employed in fighting wildfires, but are currently only used for secondary tasks such as mapping fires, helping in coordinating ground task forces, detecting fires and surveillance. For example, the use of UAVs to ignite prescribed fires has been proposed. The proposed method uses swarms of multicopters to hold a long hose and pass over obstacles to reach fire sources. UAV and mixed UAV-UGV (Unmanned Ground Vehicle) swarms are employed for monitoring wildfires.

1.1 Existing System

In the existing system we have a method where human involvement is necessary in the rescue operation of fire accidents. This method has a risk of human life and the damage of properties is higher.

1.2 ProposedSystem

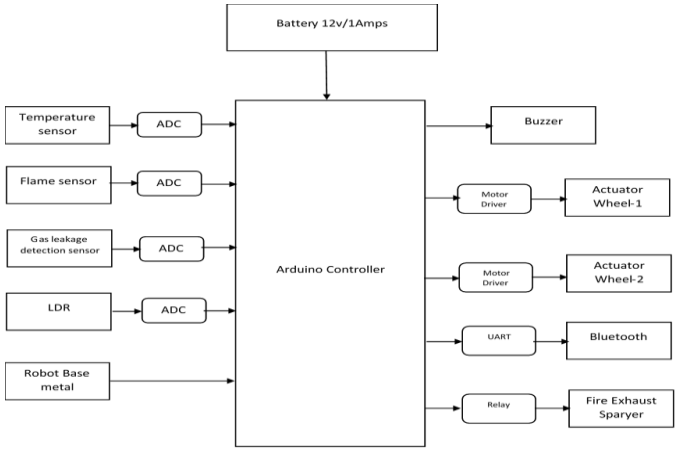
A multi-sensored robot is designed to detect the presence of fire and programmed to spray water on the fire. Fire accidents in houses and office places, the water is spayed only in the place where fire is present. Unlike in the existing system where water if sprayed in the entire room

2. ADVANTAGES

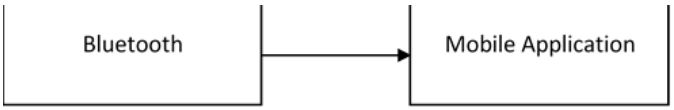
Risk of Human Life is avoided

Damages can be reduced

3. BLOCK DIAGRAM



CONTROL UNIT



4. CONCLUSIONS

In this project, a novel approach to aerial firefighting has been proposed and experimentally verified. During the maneuvers, the UGV flew at close to twice its maximum conventional speed for the given payload. Had the target been on fire, the achieved high speed would have considerably reduced the heat exposure. Namely, compared to conventional trajectories, this method would have allowed the UGV to drop a larger payload from a closer distance from the target. When a malfunction in the releasing mechanism was simulated, the UGV was not able to recover from the vertical speed it had gained during the maneuver. The UGV crashed as expected, proving that the generated trajectory was as aggressive as the UGV could perform under the given constraints.

5. REFERENCES

[1] J. K. Balch et al., "Human-started wildfires expand the fire niche across the united states," Proc. Nat. Acad. Sci. USA, vol. 114, no. 11, 2017, pp. 2946–2951.

[2] J. T. Abatzoglou and A. P. Williams, "Impact of anthropogenic climate change on wildfire across western US forests," Proc. Nat. Acad. Sci. USA, vol. 113, no. 42, pp. 11770–11775, 2016.

[3] E. Beachly et al., "A micro-uas to start prescribed fires," in Proc. Int. Symp. Exp. Robot., 2016, pp. 12–24.

[4] T. M. Whitalker and M. Corson, "Tethered unmanned aerial vehicle fire fighting system," U. S. Patent US9764839B2, Sep. 2017.

[5] M. Kumar et al., "Cooperative control of multiple uninhabited aerial vehicles for monitoring and fighting wildfires," J. Aerosp. Comput., Inf. Commun., vol. 8, pp. 1–16, 2011.

[6] C. Phan and H. H. T. Liu, "A cooperative UAV/UGV platform for wildfire detection and fighting," in Proc. Asia Simul. Conf. 7th Int. Conf. Syst. Simul. Scientific Comput., 2008, pp. 494–498.

[7] A. Vidovic and D. Dimini, "Possibility of implementing unmanned aerial vehicles in firefighting operations," in Proc. Znanost i Razvitak Prometa, Apr. 2014, pp. 107–116.

[8] B. Aydin et al., "Use of fire-extinguishing balls for a conceptual system of drone assisted wildfire fighting," Drones, vol. 3, no. 1, p. 17, Feb. 2019.

[9] W. Marchant and S. Tosunoglu, "Rethinking wildfire suppression with swarm robotics," in Proc. 29th Florida Conf. Recent Adv. Robot., 2016.

[10] H. Qin et al., "Design and implementation of an unmanned aerial vehicle for autonomous firefighting missions," in Proc. 12th IEEE Int. Conf. Control Autom., June. 2016, pp. 62–67.

[11] L. Chang and Y. Jia, "Robust H∞ control for tanker station-keeping with mass and inertia variation," in Proc. 13th IEEE Conf. Autom. Sci. Eng., Aug. 2017, pp. 340–345.

[12] S. D. Lucia, G. D. Tipaldi, and W. Burgard, "Attitude stabilization control of an aerial manipulator using a quaternion-based backstepping approach," in Proc. IEEE Eur. Conf. Mobile Robots, Sep. 2015, pp. 1–6.

[13] I. Sadeghzadeh et al., "Payload drop application of unmanned quadrotor helicopter using gain-scheduled pid and model predictive control techniques," in Proc. Intell. Roboti. Appl., 2012, pp. 386–395.

[14] S. H. Mathisen et al., "Approach methods for autonomous precision aerial drop from a small unmanned aerial vehicle," in Proc. 20th IFAC World Congr., 2017, pp. 3566–3573.

[15] C. K. Lai, M. Lone, P. Thomas, J. Whidborne, and A. Cooke, "On-board trajectory generation for collision avoidance in unmanned aerial vehicles," in Proc. Aerosp. Conf., Mar. 2011, pp. 1–14.

[16] D. Mellinger and V. Kumar, "Minimum snap trajectory generation and control for quadrotors," in Proc. IEEE Int. Conf. Robot. Autom., May 2011, pp. 2520–2525..