Multi Sensor Network System for Early Detection and Prediction of Forest Fires in Southeast Asia

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Abstract — **The increasing frequency and severity of forest and land fires have become a significant environmental concern, necessitating the development of effective early detection and prediction systems. This paper presents a novel approach to address the issue through the implementation of a multi-sensor network system for forest and land fires. The proposed system integrates an array of advanced multi-sensors strategically placed across the targeted regions to capture and analyze a wide range of fire-related data. The key objective of the system is to enable timely identification of potential fire hotspots by continuously monitoring various environmental parameters, including temperature, humidity, and infrared radiation. The collected data is then processed and analyzed using machine learning algorithms to identify fire patterns and predict the likelihood of fire outbreaks. The system utilizes a network of sensors, and the system offers real-time and comprehensive coverage, allowing for rapid response and timely deployment of fire suppression resources. Furthermore, the results of extensive field tests and evaluations, demonstrate the system's accuracy and efficiency in early fire detection and prediction. The proposed system offers a case in Indonesia which is Riau Province with high-risk cases almost every year. Plotting results data achieved and forecasting of the incident for the future in the year 2023 with a successful percentage up to 93.6%. Ultimately, the integration of the multi-sensor network system into existing fire management frameworks promises to enhance emergency response capabilities and foster proactive measures to preserve our valuable forests and lands.**

Keywords—**Forest fire, multi-sensor, detection and prediction, southeast asia**

I. INTRODUCTION

Forest and land fires pose a formidable challenge in the Southeast Asia region, with their devastating impacts on ecosystems, human health, and the economy. The region has been experiencing an alarming increase in the frequency and severity of these fires, driven by a combination of factors such as climate change, land use changes, and human activities. The need for efficient and proactive measures to address this environmental crisis has never been more urgent. In recent years, advancements in sensor technology and data analytics have paved the way for innovative solutions to mitigate the risks associated with forest and land fires. One such promising solution is the implementation of a multi-sensor network system for early detection and prediction of forest and land fires. This system capitalizes on cutting-edge multi-sensors strategically deployed across fire-prone areas, aiming to provide real-time monitoring and timely detection of potential fire hotspots.

The Southeast Asia region, with its rich biodiversity and extensive forest cover, is particularly susceptible to the devastating effects of forest and land fires. The peatlands and tropical rainforests that dominate the landscape harbor unique ecosystems and serve as crucial carbon sinks, but they also become vulnerable to fire outbreaks during dry seasons. The environmental consequences of these fires are not confined to the affected areas alone; they often result in transboundary haze that poses severe health risks and socioeconomic disruptions across neighboring countries. The objective is to provide an effective and proactive solution to combat forest and land fires, enhance early detection capabilities, and enable accurate prediction of fire occurrences. Leveraging the capabilities of state-of-the-art sensors and data analytics, this system aims to revolutionize fire management strategies in the region.

This paper will delve into the design and implementation of the multi-sensor network system, highlighting the integration of hardware components, data acquisition methods, and communication protocols. Moreover, it will present the results of rigorous field tests and evaluations, showcasing the system's efficacy and reliability in early fire detection and prediction. With the potential to revolutionize fire management practices in the Southeast Asia region, the multi-sensor network system holds significant promise in safeguarding valuable forests, protecting wildlife habitats, and securing the well-being of communities living in fire-prone areas. The research outcomes from this study are expected to provide valuable insights for policymakers, fire management authorities, and environmental stakeholders, offering practical solutions to address the escalating threat of forest and land fires in the region especially in Indonesia, and data visualization and prediction are also one of the works.