UNIVERSITI TEKNOLOGI MARA

JIIICaS 2024
JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM

PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)

"Flourish and Nurturing Sustainable Innovation for a Prosperous Nation"

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Editorial Board

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector

Assalamualaikum warahmatullahi Wabarakatuh, Salam Sejahtera, Salam Malaysia MADANI and Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most Merciful.

It is a great honor to welcome you to the Johor International Innovation, Invention, Competition, and Symposium 2024 (JIIICaS 2024). This event connects various disciplines, focusing on education and engaging educators, students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and determination to turn those ideas into reality. The remarkable projects showcased today highlight the dedication and spirit of all participants. Initiatives like this not only explore new technologies but also cultivate skills and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor Branch, we are fully committed to fostering a dynamic culture of innovation, promoting the commercialization of new products, and encouraging meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all sponsors, judges, the College of Computing, Informatics and Mathematics, UiTM Pasir Gudang Campus as the event organizer, as well as to the researchers and participants for their hard work in making this event a success. Let us continue striving for innovation and excellence. May the ideas presented today inspire us and lay the groundwork for future achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
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(A-ST097) FORESTGUARD ALERT

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ABSTRACT

Forest fires are becoming increasingly frequent and severe due to rising global temperatures driven by climate change, often escalating from small incidents to widespread destruction. This project addresses the critical challenge of controlling and extinguishing these fires by proposing the use of IoT-based sensors for early detection. The system deploys sensors in forested areas to detect initial signs of fire, such as temperature spikes and smoke. Once these signs are detected, the system triggers alarms and sends immediate notifications to authorities and nearby residents, facilitating a rapid response that significantly reduces the risk of large-scale damage. In addition to forested areas, this innovative technology can be applied to other fire-prone locations, such as agricultural farms, where early detection is crucial for protecting crops and preventing economic losses. The IoT-based sensors offer a reliable early detection system that enhances fire management practices, enabling quicker and more effective interventions. The ultimate goal of this project is to mitigate the adverse impacts of forest fires by providing a robust and proactive approach to fire detection and management. By safeguarding both the environment and local communities, this system contributes to the overall safety and resilience of vulnerable regions. It represents a significant advancement in the field of fire management, leveraging modern technology to address a pressing global issue. Through the deployment of these sensors, the project not only aims to prevent the extensive destruction caused by forest fires but also to offer a scalable solution that can be adapted to various environments, promoting sustainability and economic stability across different sectors.

Keywords: IoT-based sensors, Forest fires, Fire management, Early detection, Wildfire prevention

1. INTRODUCTION

Forest fires have become an increasingly urgent global issue, with their frequency and intensity rising due to climate change and human activities. In recent years, the world witnessed a significant increase in forest fire incidents, resulting in extensive damage to ecosystems, wildlife habitats, and human communities. The primary challenge in managing forest fires is the lack of effective early detection systems, which often leads to uncontrolled fires spreading rapidly and causing widespread destruction. This project seeks to address this critical gap by developing an innovative forest fire alarm system using IoT technology, specifically designed for early detection and rapid

response. The proposed system leverages a Raspberry Pi as the central hub, sensors and software applications for effective detection and monitoring. By offering a cost-effective and easily deployable solution, this IoT-based system aims to significantly improve early fire detection, enhance communication between authorities and local residents, and ultimately reduce the devastating impacts of forest fires on both human life and the environment.

2. OBJECTIVE

The project aims to significantly enhance early detection capabilities for forest fires by integrating advanced sensor technology and IoT-driven notification systems. By combining the MQ2 smoke sensor and flame sensor, the system is designed to detect even the smallest signs of fire, enabling timely alerts. These alerts are delivered through a dual notification system, utilizing both Telegram for immediate, real-time warnings to users and ThingSpeak for comprehensive data visualization and monitoring by authorities. This integration ensures a robust and responsive solution, providing critical information to prevent the spread of forest fires and minimize potential damage.

3. METHODOLOGY

This project implements a Waterfall methodology. This methodology is a linear and sequential approach to product development, where each phase of the project must be completed before the next one begins. It typically follows a defined set of stages: requirements gathering, design, implementation, verification/testing, and maintenance. In this methodology, the process flows in one direction like a waterfall, with minimal overlap between stages. This approach is well-suited for projects with clear objectives and stable requirements, as it allows for thorough documentation and structured progress.

4. IMPLEMENTATION

The implementation of the project is as illustrated in Figure 1. Several hardware components are used to develop a complete prototype such as Raspberry Pi, MQ2 smoke sensor, flame sensor, web camera, and buzzer. Software integration is essential to enable remote management of the device through mobile phones. Python and Geany are used for the programming part, ThingSpeak as a cloud-based IoT analytics platform that allows users to collect, analyze, and visualize data from various sensors and devices in real time, and Telegram as a cloud-based messaging application.

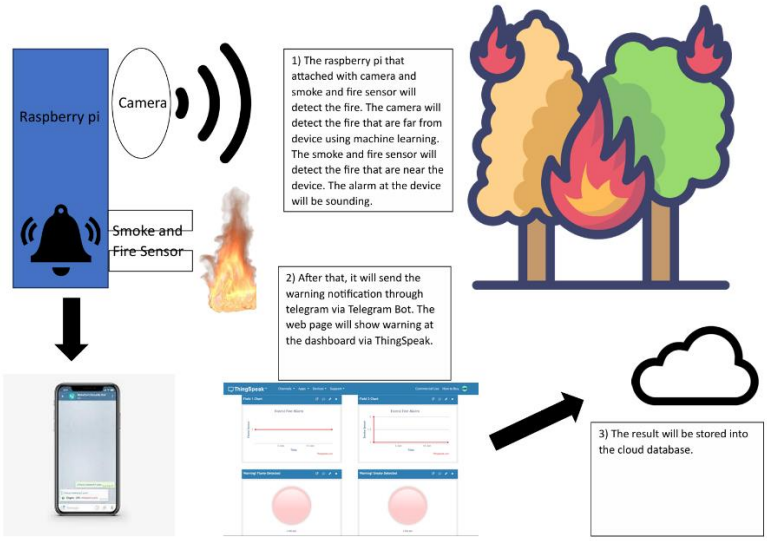

Figure 1: Overview of the system

5. RESULT

An overview of the key features of the project are as follows.

a) Environmental monitoring with sensors
Flame sensors: These sensors detect the presence of flames by measuring the intensity of infrared light. When flames are detected, the system can trigger an alert.
MQ2 smoke sensor: This sensor measures smoke levels in the air, which can indicate the presence of fire or other pollutants. High smoke levels will prompt the system to send notifications.

b) Real-time data collection
Continuous monitoring: The system continuously monitors environmental conditions to detect any signs of fire or smoke, providing real-time data on the status of the monitored area.
Data logging: The system can log data for historical analysis, helping to track patterns and improve future response strategies.

c) Immediate alerts and notifications
Telegram bot integration: The system uses a Telegram bot to send real-time notifications to users. This provides an immediate alert to anyone subscribed to the bot, ensuring timely awareness.
ThingSpeak dashboard: This cloud-based platform displays real-time data and alerts, which can be accessed by authorities or emergency response teams. It provides a centralized view of the data from multiple monitoring points.

d) IoT connectivity
Raspberry Pi: This low-cost, compact computing unit serves as the central hub of the system. It processes sensor data and manages communication between sensors, notifications, and dashboards.
Network integration: The system connects to the internet via Wi-Fi, allowing for remote access and control. It ensures that alerts and data can be transmitted to relevant parties regardless of their location.

e) Cost-effective and scalable
Affordable components: Utilizing inexpensive hardware like the Raspberry Pi and sensors helps keep the overall cost low, making it accessible for widespread deployment.
Scalability: The system can be scaled to cover larger areas by adding more sensors and Raspberry Pi units. This flexibility allows for the expansion of monitoring coverage as needed.

f) User-friendly interface
Telegram notifications: The use of Telegram for notifications ensures that alerts are easily received and understood by users, who can set up custom alerts and preferences.
ThingSpeak dashboard: The dashboard provides a visual representation of data, making it easy for authorities to monitor conditions and act.

g) Deployment and maintenance
Ease of installation: The system is designed to be easy to deploy in various forested or remote areas, with minimal setup required.
Low maintenance: The components are chosen for their durability and low maintenance needs, ensuring reliable long-term operation.

6. CONCLUSION

In conclusion, this project contributes significantly to the early detection and rapid response to forest fires, addressing the critical need for more effective fire management systems. By integrating the MQ2 smoke sensor and flame sensor, the system offers enhanced detection capabilities, allowing for prompt identification of potential fire incidents. The use of Telegram for real-time alerts and ThingSpeak for data visualization ensures that users and authorities are informed quickly and clearly, facilitating swift action to minimize damage. This project not only improves current forest fire detection and response mechanisms but also lays the groundwork for future enhancements, such as incorporating AI-driven predictive analytics and expanding the system to cover larger areas. Further research could explore the integration of additional environmental sensors, drone-based surveillance, and machine learning algorithms to predict and prevent fires before they escalate, making the system even more robust and comprehensive in safeguarding our forests and communities.