IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154261

AI-Based Smart Forest Safety Monitoring System Using Real-Time Risk Analysis

N. Shahinaz[1], Nanditha N M[2], Netravathi Hosamani[3], K.V. Hima Rashmi[4], Dr. Muhibur Rahman T.R[5]

6th Sem B.E(CS&E), Balllari Institute of Technology and Maanagement(BITM), Ballari, Karnataka-583104[1-4]

Associate Professor, Department of computer Science and Engineering,

Ballari Institute of Technology and Management(BITM), Ballari, Karnataka – 583104[5]

Abstract: Forest tourism has seen a steady rise in recent years, as more people are drawn to outdoor adventures and nature-based experiences. Despite its popularity, ensuring the safety of tourists in remote and unpredictable forest environments continues to be a major concern. This paper presents a smart forest safety monitoring system that utilizes artificial intelligence to improve user safety through continuous tracking and intelligent risk assessment.

The proposed system integrates GPS-based location tracking with real-time risk evaluation and behavior analysis to provide timely alerts and guidance. It features a user registration module that collects essential personal and medical information, allowing the system to deliver more personalized safety support. In addition, the system is capable of detecting unusual situations, such as extended periods of inactivity or entry into high-risk zones, by analyzing sensor data and location patterns.

During emergency situations, the system can automatically trigger alerts and record short video clips, which can assist in verification and rescue efforts. The system is implemented using modern web technologies, supported by a Flask-based backend for efficient data handling and processing. The results demonstrate that the proposed solution can effectively identify potential risks and respond in a timely manner, making it a practical and reliable approach for enhancing tourist safety in forest environments.

Keywords: Artificial Intelligence (AI), Forest Tourist Safety, Real-Time Risk Assessment, GPS-Based Tracking Systems, Emergency Detection and Response

I. INTRODUCTION

In recent years, forest tourism has gained significant attention as people increasingly seek adventure, exploration, and closer interaction with nature. While these environments offer unique experiences, they also present serious safety challenges. Tourists often travel through remote areas where there is limited infrastructure, poor network connectivity, and minimal supervision. In such conditions, incidents like getting lost, wildlife encounters, or sudden health emergencies can become highly dangerous if timely assistance is not available.

Traditional safety systems primarily rely on basic GPS tracking or manual monitoring methods. Although these approaches help in identifying a user's location, they lack the ability to analyze situations in real time or predict potential risks. As a result, most existing solutions are reactive in nature, responding only after an incident has occurred rather than preventing it in advance.

With the rapid advancement of artificial intelligence and smart technologies, there is an opportunity to develop more intelligent and proactive safety systems. AI-based approaches can analyze user behavior, environmental conditions, and movement patterns to identify potential risks at an early stage. This enables timely alerts and improves the chances of preventing critical situations.

In this context, the proposed system introduces an AI-based smart forest safety monitoring solution that integrates real-time GPS tracking, risk prediction, and emergency detection into a unified platform. The system continuously monitors user activity, evaluates risk levels, and provides timely alerts and guidance. By combining multiple technologies, it aims to enhance safety, reduce response time, and offer a more reliable solution for tourists in forest environments.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 4, April 2026
DOI: 10.17148/IJARCCE.2026.154261

II. LITERATURE REVIEW

[1] Early research on outdoor safety systems has primarily focused on GPS-based tracking technologies (2010–2015). These systems allow users to share their real-time location, which is useful for basic monitoring and navigation. However, they do not provide deeper insights into user behavior or potential risks, limiting their effectiveness in preventing dangerous situations.
[2] Several studies have explored mobile-based emergency alert systems that use sensor data to detect accidents and notify authorities (2012–2017). While these systems help improve response time during emergencies, they are mostly reactive in nature and lack the ability to predict risks before they occur.
[3] With the advancement of artificial intelligence, researchers have developed intelligent safety monitoring systems that analyze user activity and environmental conditions (2016–2021). Although these systems aim to identify unsafe situations using real-time data, they often face challenges such as limited accuracy and dependence on large datasets.
[4] Some studies have investigated the use of wearable devices and sensors for detecting falls and abnormal movements (2014–2019). These systems are effective in identifying physical emergencies, but they are generally limited to specific events and do not consider environmental risks or user movement patterns.
[5] Research on IoT-based safety systems has introduced the integration of multiple devices for monitoring users in remote areas (2015–2020). While these systems enhance connectivity and data collection, they often lack real-time intelligence and advanced decision-making capabilities.
[6] Environmental monitoring systems have also been proposed to track conditions such as temperature, humidity, and wildlife activity in forest regions (2013–2018). Although these systems provide valuable environmental data, they do not directly address individual tourist safety.
[7] Video-based surveillance systems have been used for monitoring and detecting incidents in certain environments (2014–2020). While they offer visual evidence, their implementation can be costly and may raise privacy concerns, especially in open and natural settings.
[8] More recent studies in artificial intelligence have focused on risk prediction models that analyze multiple factors to estimate potential dangers (2018–2023). These approaches show promising results; however, their effectiveness often depends on the quality of data and system design.
[9] Empirical research in software engineering highlights the importance of combining methods such as surveys, experiments, and case studies to improve system reliability (2005–2015). These approaches help researchers better understand user needs and evaluate system performance.
[10] Overall, existing research tends to focus on individual aspects such as tracking, emergency detection, or environmental monitoring (2010–2023). There is still a lack of integrated systems that combine these features into a single platform for comprehensive safety management.
[11] To address these gaps, the proposed Smart Forest AI Safety Monitoring System integrates GPS tracking, sensor-based emergency detection, and AI-driven risk analysis (2024). This unified approach enables continuous monitoring, early risk identification, and faster response to emergencies.
[12] By combining multiple technologies into a single system, the proposed solution offers a more proactive and efficient approach to ensuring tourist safety in forest environments, overcoming many limitations of existing methods (2024).

III. PROPOSED SYSTEM

The proposed system is designed as an integrated and intelligent solution aimed at improving tourist safety in forest environments. It combines multiple components that work together seamlessly to provide continuous monitoring and real-time support.

The process begins with a user registration module, where individuals enter important personal, medical, and travel-related details. This information allows the system to better understand each user's condition and provide more personalized safety assistance when needed.

Once the user enters the forest area, the system activates GPS-based tracking to continuously monitor their location and movement. By analyzing this data along with user behavior patterns, the system calculates a dynamic risk score. This score is determined by several factors, including the time of travel, movement consistency, and proximity to areas that may pose potential danger.

To further enhance safety, the system includes an emergency detection mechanism that uses device sensors to identify sudden movements, impacts, or falls. When such events are detected, the system automatically generates alerts to ensure a quick and effective response. In addition, a video recording feature captures short clips during critical situations, which can be valuable for verification and rescue purposes.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 4, April 2026

DOI: 10.17148/IJARCCE.2026.154261

Overall, the proposed system adopts a proactive approach to safety by continuously monitoring conditions and identifying potential risks before they develop into serious incidents.

IV. METHODOLOGY

The proposed system operates by continuously gathering and analyzing data in real time to evaluate the safety of the user. It relies on multiple sources of input, including user-provided information, GPS-based location data, and sensor readings obtained directly from the user's device. By combining these inputs, the system is able to build a comprehensive understanding of the user's current situation.

To determine the level of risk, the system uses a rule-based approach in which different conditions contribute to an overall risk score. For instance, traveling during late hours is considered more hazardous and therefore increases the risk level. In contrast, steady and consistent movement is interpreted as normal behavior and helps keep the risk score low. Similarly, if the user moves into areas identified as high-risk zones, the system adjusts the score accordingly to reflect the increased danger.

Beyond environmental conditions, the system also focuses on analyzing user behavior. It examines recent movement patterns to identify any unusual or unexpected changes. For example, if the user remains inactive for an extended period, it is treated as a potential warning sign. Emergency situations are detected through device sensors, where sudden acceleration or impact may indicate a fall or accident.

Based on the calculated risk level, the system generates timely alerts and provides relevant guidance to the user. This continuous process of monitoring, analysis, and response enables the system to identify potential risks at an early stage and take preventive action, thereby improving overall safety in forest environments.

V. IMPLEMENTATION

The system is developed using modern web technologies to ensure that it is both accessible and easy to use. The frontend is built with HTML, CSS, and JavaScript, providing a clean and interactive interface. Through this interface, users can register their details, monitor their safety status, and receive alerts in real time. Visual components such as dashboards and indicators are included to present safety information in a clear and user-friendly manner.

On the backend, the system is implemented using the Flask framework. Flask is responsible for handling data processing, managing application routes, and connecting different modules of the system. It ensures smooth communication between the frontend and backend while maintaining the overall system logic.

To support real-time functionality, browser-based APIs are used to access device features such as geolocation and camera. These APIs allow the system to continuously track the user's position and capture video when required during critical situations.

The system is designed using a modular approach, where key components such as risk evaluation, behavior analysis, and emergency detection function independently but are closely integrated. This design improves overall efficiency and also makes the system easier to maintain and expand in the future.

VI. RESULTS AND DISCUSSION

The system was tested under a variety of scenarios to evaluate its performance and reliability. During normal conditions, the system consistently maintained a low risk score, indicating that the user's environment and behavior were safe.
When high-risk situations were simulated—such as traveling during late hours or remaining inactive for extended periods—the system successfully detected these changes and adjusted the risk score accordingly. It also generated timely alerts to warn the user about potential dangers.

The emergency detection feature performed effectively by identifying sudden movements and triggering appropriate safety notifications. Additionally, the video recording feature worked as expected, capturing useful visual evidence during simulated emergency events.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 4, April 2026
DOI: 10.17148/IJARCCE.2026.154261

Overall, the results demonstrate that the system is capable of accurately analyzing real-time data and responding quickly to potential risks. The integration of multiple features not only improves system reliability but also significantly enhances user safety.

VII. CONCLUSION

This paper presented an AI-based smart forest safety monitoring system aimed at improving tourist safety through real-time monitoring and intelligent analysis. By combining GPS tracking, risk assessment, and emergency detection, the system offers a proactive approach to managing safety in forest environments.

The results show that the system can effectively identify potentially dangerous situations and provide timely alerts, thereby reducing response time and helping to prevent accidents. The integration of multiple functionalities makes the system both practical and reliable for real-world use.

In the future, the system can be further enhanced by incorporating advanced machine learning techniques to improve prediction accuracy. Additional improvements such as offline functionality for remote areas and integration with emergency response services can further increase its effectiveness and usability.

REFERENCES

[1]. S. A. Zubair and M. A. Shah, "Smart tracking system for outdoor safety using GPS and IoT," *International Journal of Advanced Computer Science and Applications*, vol. 9, no. 6, pp. 234–240, 2018.
[2]. A. K. Mishra and P. Singh, "Mobile-based emergency alert system using sensors and GPS tracking," in *Proceedings of the IEEE International Conference on Communication Systems*, pp. 120–125, 2019.
[3]. J. Liu, Y. Zhang, and X. Wang, "An AI-based risk prediction model for smart monitoring systems," *IEEE Access*, vol. 8, pp. 145678–145689, 2020.
[4]. R. K. Sharma and S. Verma, "Wearable sensor-based fall detection system for emergency response," *International Journal of Engineering Research and Technology*, vol. 7, no. 5, pp. 112–118, 2018.
[5]. P. Gupta, N. Jain, and R. Agarwal, "IoT-based smart safety system for monitoring in remote areas," *Procedia Computer Science*, vol. 132, pp. 1351–1358, 2019.
[6]. M. Chen and L. Zhao, "Environmental monitoring in forest regions using wireless sensor networks," *IEEE Sensors Journal*, vol. 19, no. 11, pp. 4567–4575, 2019.
[7]. T. Nguyen and H. Kim, "Real-time video surveillance system for safety monitoring using AI techniques," in *Proceedings of the IEEE International Conference on Multimedia and Expo*, pp. 1–6, 2020.
[8]. S. Patel and K. Mehta, "An intelligent risk assessment system based on machine learning techniques," *Journal of Artificial Intelligence Research*, vol. 65, pp. 45–60, 2021.
[9]. D. S. Kumar and V. Reddy, "A smart tourist safety system using GPS and mobile applications," in *Proceedings of the International Conference on Smart Computing*, pp. 89–94, 2018.
[10]. A. Singh, R. Tiwari, and P. Yadav, "Emergency detection using mobile sensors and accelerometer data," in *Proceedings of the IEEE Conference on Smart Technologies*, pp. 210–215, 2020.
[11]. Y. Zhou, Q. Li, and H. Chen, "AI-enabled real-time monitoring system for smart environments," *IEEE Internet of Things Journal*, vol. 9, no. 3, pp. 1678–1687, 2022.
[12]. "AI-Based Smart Forest Safety Monitoring System Using Real-Time Risk Analysis," Proposed System, 2024.

