

“Smart Tourist Safety System using AI & Geo-Fencing”

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Abstract:

The rapid growth of tourism has increased safety concerns such as identity fraud, missing tourist cases, health emergencies, crowd panic, and delayed emergency response. This research proposes a **Smart Tourist Safety Monitoring & Incident Response System** using Artificial Intelligence (AI), Geo-Fencing, Blockchain, and IoT technologies. The system provides a Blockchain-based Digital Tourist ID for secure and instant verification at checkpoints through QR codes, reducing fake identity risks. Geo-fencing and GPS tracking monitor tourist movement and send alerts when entering high-risk zones.

An AI-based anomaly detection system identifies unusual behavior, route deviation, or prolonged inactivity. A mobile app with a one-click SOS button instantly shares live location with police and family members. IoT smart bands monitor health conditions and trigger automatic alerts during emergencies. The system also includes multilingual support, disaster alerts, and a police dashboard with real-time heatmaps. Overall, the solution improves tourist safety, response time, and data security.

Keywords: Smart Tourism, Artificial Intelligence, Geo-Fencing, Blockchain Technology, Digital Tourist ID, IoT Devices, GPS Tracking, Anomaly Detection, Data Privacy

1.Introduction:

Tourism plays a vital role in the economic development of India. With its rich cultural heritage, historical monuments, natural landscapes, and diverse traditions, India attracts millions of domestic and international tourists every year. According to India Tourism Statistics 2023, the number of tourist arrivals has steadily increased, contributing significantly to employment generation and foreign exchange earnings [1]. However, global tourism reports emphasize that the growth of tourism also increases safety and security challenges, requiring stronger protective frameworks and crisis management systems [2]. Ensuring the protection of tourists has therefore become a major responsibility for government authorities, tourism departments, and law enforcement agencies.

Despite various safety measures, tourists in India often face identity fraud, theft, harassment, missing person cases, health emergencies, natural disasters, and delayed emergency response. The World Economic Forum highlights the need for secure and seamless traveler identity systems to enhance global travel safety [11]. Manual identity verification at hotels and

checkpoints remains time-consuming and vulnerable to fake documentation. These concerns highlight the urgent need for a smart and technology-driven safety infrastructure.

The rapid advancement of Artificial Intelligence (AI), Geo-Fencing, and GPS tracking technologies provides new opportunities to transform traditional safety systems into intelligent monitoring solutions. AI can analyze large datasets to detect abnormal patterns, unusual crowd behavior, and potential distress situations [5]. AI-based CCTV crowd analysis systems have proven effective in preventing panic and stampede situations in public gatherings [6]. Geo-fencing technology enables the creation of virtual boundaries around high-risk areas and automatically sends alerts when a tourist enters a restricted zone [8]. Additionally, GPS-based tracking systems significantly reduce response time during emergencies by providing real-time location data [9].

Blockchain technology offers a secure and tamper-proof mechanism for digital identity management. The foundational concept of blockchain was introduced by Nakamoto [3], and recent studies highlight its application in secure digital identity systems [4]. Blockchain-based systems ensure encrypted data storage, prevent unauthorized modifications, and enhance privacy protection [12]. A Blockchain-based Digital Tourist ID can therefore simplify QR-based verification at airports, hotels, and checkpoints while minimizing identity fraud.

IoT-based wearable devices further strengthen tourist protection mechanisms. Smart bands equipped with health sensors can monitor vital parameters such as heart rate and oxygen levels, and automatically trigger alerts in case of abnormal readings [7]. Such systems are particularly beneficial for senior citizens, children, and solo travelers visiting remote areas.

Crowd control and law enforcement efficiency are also critical components of tourist safety. Smart policing models integrate real-time dashboards, heatmaps, and data analytics to monitor tourist density and risk zones [10]. These digital policing frameworks improve coordination between authorities and enable faster response to emergencies.

Considering these technological advancements, this research proposes a Smart Tourist Safety Monitoring and Incident Response System integrating AI, Geo-Fencing, Blockchain, IoT, and real-time analytics. The system aims to shift from reactive emergency response to proactive risk prevention, enhance coordination among stakeholders, and improve overall tourist confidence. By combining secure digital identity, intelligent monitoring, and privacy-preserving technologies, the proposed framework seeks to strengthen India's tourism ecosystem in a safe and sustainable manner.

2. Objective:

1. To explore the major safety challenges faced by tourists in India, including identity fraud, missing cases, health emergencies, and delayed response systems.
2. To assess the effectiveness of blockchain-based Digital Tourist ID in improving identity verification and reducing fake documentation risks.
3. To analyze the impact of AI-based anomaly detection and geo-fencing technologies on enhancing tourist safety and real-time risk monitoring.

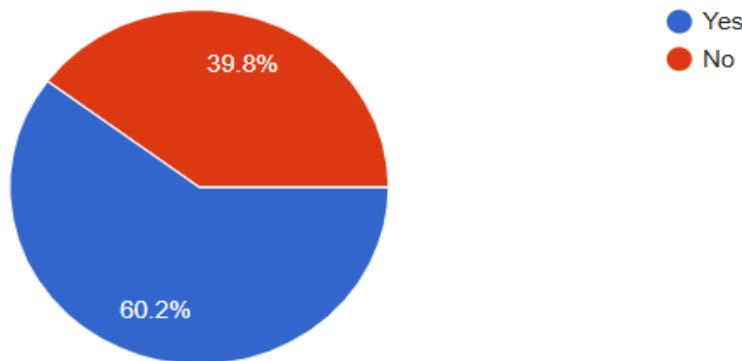
4. To examine the role of GPS tracking, IoT health devices, and SOS alert systems in providing quick emergency response and assistance.
5. To investigate the usefulness of police dashboards, heatmaps, and crowd monitoring systems in improving law enforcement efficiency and public safety.
6. To suggest strategies for implementing a secure, privacy-focused, and technology-driven tourist safety system in India.

Hypothesis:

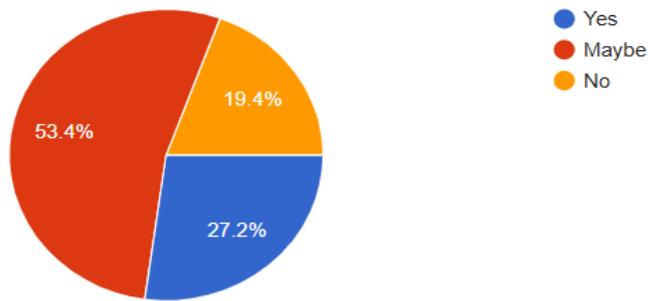
- The implementation of an AI and Geo-Fencing based Smart Tourist Safety System significantly improves tourists' perceived sense of safety compared to traditional safety measures.
- The use of Blockchain-based Digital Tourist ID and real-time emergency alert features significantly reduces response time and identity verification delays in tourist-related incidents.

3. Experiment:

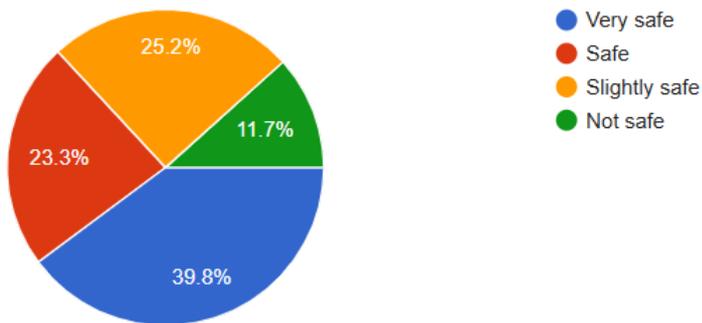
Response related Have you ever felt unsafe while traveling in India?



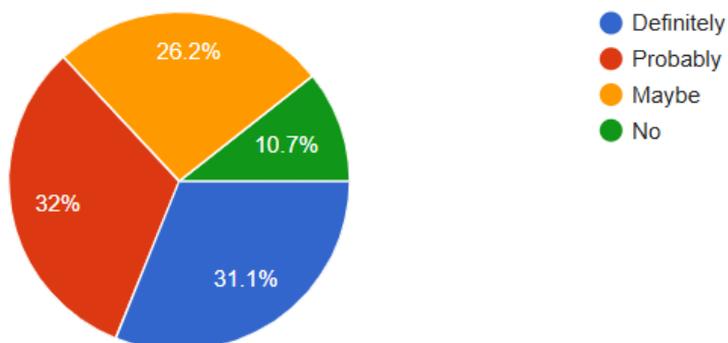
Response related Do you think police having a dashboard with tourist density maps/alerts increases safety?



Response related If AI anomaly detection identifies sudden inactivity or distress, how safe would you feel?



Response related If the smart safety system is free and secure, would you use it ?



Research Methodology:

The study is based on a primary survey conducted among 103 respondents from Dhule district. A structured questionnaire was designed to collect data regarding tourist safety concerns, awareness of smart technologies, and willingness to adopt an AI and Geo-Fencing based safety system. The collected responses were analyzed using percentage and comparative analysis methods to evaluate user perception and system acceptance.

Hypothesis Testing Through Statistical Method: Chi - Square Test :-

HYPOTHESIS 1: Response related Have you ever felt unsafe while traveling in India?

Thus, applying the Formula $\chi^2 = \sum(O_i - E_i)^2 / E_i$

- **O_i**= Observed Frequency (Response collected from survey),
- **E_i**=Expected Frequency (Expected Response)

Showing calculation of $\sum(O_i - E_i)^2 / E_i$ in Dhule District.

Sr.No.	Response	O _i	E _i	O _i -E _i	(O _i -E _i) ²	(O _i -E _i) ² /E _i
1	YES	62	51.5	10.5	110.25	2.14
2	NO	41	51.5	-10.5	110.25	2.14
	Total	103				4.28

$$\sum(O_i - E_i)^2 / E_i = 4.28$$

Degree of freedom (d.f) is 1

Therefore, Tabulated value of χ^2 as 1 degree of freedom is 3.841

$$\chi^2 = 4.28 \quad 4.28 > 3.841$$

Result:

The Chi-square test result ($\chi^2 = 4.28$) is higher than the tabulated value (3.841) at 1 degree of freedom, leading to the rejection of the null hypothesis at the 5% level of significance. This confirms that the responses are statistically significant. With 62 respondents answering “Yes” and 41 answering “No,” the findings indicate that a considerable number of tourists have felt unsafe while traveling in India. The study highlights the need for improved safety measures and the implementation of smart tourist safety systems to enhance traveler confidence and security.

HYPOTHESIS 2 Which of the following features is most important for tourist safety.

Thus, applying the Formula $\chi^2 = \sum (O_i - E_i)^2 / E_i$

- **O_i**= Observed Frequency (Response collected from survey),
- **E_i**=Expected Frequency (Expected Response)

Showing calculation of $\sum (O_i - E_i)^2 / E_i$ in Dhule District.

Sr. No.	Response	O _i	E _i	O _i -E _i	(O _i -E _i) ²	(O _i -E _i) ² /E _i
1	AI Safety Score	29	25.75	3.25	10.56	0.41
2	Panic Button	33	25.75	7.25	52.56	2.04
3	Geo-fencing Alerts	29	25.75	3.25	10.56	0.41
4	Live Location Sharing	12	25.75	-13.75	189.06	7.34
	Total	103				10.2

$$\sum (O_i - E_i)^2 / E_i = 10.2$$

Degree of freedom(D.F.) is 3

Therefore, Tabulated value of χ^2 as 3 degree of freedom is 7.815*

$$\chi^2 = 10.2 \quad 99.72 > 7.815^*$$

Result:

The Chi-square test result ($\chi^2 = 10.2$) is higher than the tabulated value (7.815) at 3 degrees of freedom at the 5% level of significance. Therefore, the null hypothesis is rejected. This indicates that there is a statistically significant difference in respondents' preferences regarding the most important feature for tourist safety. Among the 103 respondents, the Panic Button (33 responses) was considered the most important feature, followed by AI Safety Score and Geo - fencing Alerts (29 responses each), while Live Location Sharing (12 responses) received comparatively less preference. The findings suggest that emergency response features like the Panic Button are prioritized by tourists for enhancing safety measures.

Conclusion:

In conclusion, the proposed Smart Tourist Safety Monitoring and Incident Response System using AI and Geo-Fencing presents a modern and technology-driven approach to enhancing tourist safety in India. The increasing number of tourists also increases risks such as identity

fraud, missing cases, health emergencies, crowd panic, and delayed response. The integration of Blockchain-based Digital Tourist ID, GPS tracking, AI anomaly detection, IoT health monitoring, and real-time geo-fencing alerts can significantly reduce these risks. The survey conducted in Dhule district indicates that users are willing to adopt a secure and smart safety system if it ensures privacy and quick emergency support. Features like SOS alerts, police dashboards with heatmaps, and safe route suggestions can improve coordination between tourists and authorities. By combining security, privacy protection, and advanced technologies, the proposed system shifts from reactive response to proactive prevention. Overall, this smart framework has the potential to strengthen tourist confidence, improve safety management, and support sustainable tourism development in India.

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