Salud, Ciencia y Tecnología - Serie de Conferencias. 2025; 4:1350
doi: 10.56294/sctconf20251350

ORIGINAL

Enhancing Road Safety: A Study of iRAD and eDAR Initiatives by the Ministry of Road Transport and Highways, Government of India

Mejorando la seguridad vial: Un estudio de las iniciativas iRAD y eDAR del Ministerio de Transporte por Carretera y Autopistas, Gobierno de la India

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Cite as: Rao GS. Enhancing Road Safety: A Study of iRAD and eDAR Initiatives by the Ministry of Road Transport and Highways, Government of India. Salud, Ciencia y Tecnología - Serie de Conferencias. 2025; 4:1350. https://doi.org/10.56294/sctconf20251350

Submitted: 28-05-2024 **Revised:** 07-09-2024 **Accepted:** 07-01-2025 **Published:** 08-01-2025

Editor: Prof. Dr. William Castillo-González

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ABSTRACT

This study examines India's initiatives to enhance road safety via the Integrated Road Accident Database (iRAD) and the e-Detailed Accident Report (e-DAR). The Ministry of Road Transport and Highways (MoRTH) has been executing many measures to improve road safety. Road accidents have become a significant threat in India. iRAD aims to address this issue by establishing a comprehensive road accident database to assist authorities in making proactive choices and ensuring 'Better and Safer Roads for All.' The main goals were to assess the efficacy of these activities in enhancing road safety measures, enabling precise data gathering, and optimizing accident reporting systems. The initiative will provide diverse insights by studying the national road accident data using data analytics techniques. The proposed system would provide analytical data via a Monitoring & Reporting Dashboard and an Analytics Dashboard to enhance understanding and support forecasting and decision-making by Apex Authorities for the formulation of new policies and strategies. The project's outcome will be enhanced road safety, namely 'Safe Road for All' in India.

Keywords: e-Detailed Accident Report; Integrated Road Accident Database, Data analytics; Ministry of Road Transport and Highways.

RESUMEN

Este estudio examina las iniciativas de la India para mejorar la seguridad vial a través de la Base de Datos Integrada de Accidentes de Tránsito (iRAD) y el Informe Detallado de Accidentes Electrónico (e-DAR). El Ministerio de Transporte por Carretera y Autopistas (MoRTH) ha estado implementando varias medidas para mejorar la seguridad vial. Los accidentes de tráfico se han convertido en una amenaza significativa en India. iRAD tiene como objetivo abordar este problema mediante la creación de una base de datos integral de accidentes de tránsito para ayudar a las autoridades a tomar decisiones proactivas y garantizar "Mejores y más Seguras Carreteras para Todos". Los principales objetivos fueron evaluar la eficacia de estas actividades para mejorar las medidas de seguridad vial, permitir la recopilación precisa de datos y optimizar los sistemas de informes de accidentes. La iniciativa proporcionará diversos conocimientos mediante el estudio de los datos nacionales de accidentes de tránsito utilizando técnicas de análisis de datos. El sistema propuesto proporcionará datos analíticos a través de un Panel de Monitoreo e Informes y un Panel de Análisis para mejorar la comprensión y respaldar la previsión y la toma de decisiones por parte de las Autoridades Apex para la formulación de nuevas políticas y estrategias. El resultado del proyecto será una mayor seguridad vial, es decir, "Carreteras Seguras para Todos" en India.

Palabras clave: Informe Detallado de Accidentes Electrónico; Base de Datos Integrada de Accidentes de

Tránsito; Análisis de Datos; Ministerio de Transporte por Carretera y Autopistas.

INTRODUCTION

Road accidents pose a significant threat to public health and safety in India, where the count of fatalities has the highest number of road accidents globally, accounting for over 11 percent of all such deaths worldwide. Approximately 1,73 lakh individuals perished in traffic accidents in 2023. This equates to an average of 474 fatalities daily, or one fatality about every three minutes, according to figures provided by states to the federal government. In 2022, as per the Ministry of Road Transport, there were 168 000 deaths in road accidents while as per the statistics provided by the national crime recording bureau (NCRB), there were 1,71 lakh deaths.[1]

This great effort under the iRAD program addresses this critical challenge by introducing a complete database that gathers precise information about road accidents.[2] This database would allow appropriate authorities to make proactive decisions for the advancement of the objective of "Better and Safer Roads for All." The e-DAR scheme adds value to iRAD by improving the accident reporting processes to ensure accuracy of data collection at the accident scene. The programs are using modern ICT tools for collecting accurate data from diverse stakeholders, including law enforcement, transportation agencies, highway authority, and medical facilities.[3]

This study conducts an analysis of the initiatives brought about by the MoRTH, Government of India i.e. iRAD and e-DAR initiatives with the purpose of improving the road safety within the Indian territory. This is done through improving the systems put in place for collection of data and reporting of accidents. The study employs data analytics strategies in order to give effective understanding on the trends as well as distribution of national road traffic accidents and the effectiveness of these measures in improving road safety outcomes at the country level. Analytical results will be presented via a monitoring and reporting dashboard, as well as an analytics dashboard, designed to enhance understanding and facilitate forecasting and informed decision-making by key policymakers.[4]

Notwithstanding the promising potential of these programs, the research recognizes several constraints, including discrepancies in regional implementation and the dependability of historical data.[5,6] This study aims to enhance the conversation on road safety in India by emphasizing the need for comprehensive data-driven initiatives to reduce the concerning rates of road accidents and deaths. Ultimately, the goal is to support the ongoing efforts to achieve "Safe Roads for All" in India, addressing the significant social and economic repercussions of road traffic accidents, which are estimated to cost the nation between USD 15,71 to 38,81 billion annually, equivalent to 0,55 to 1,35 percent of its GDP. Section 2 explains the literature review.[7]

Literature review

Accidents on the road have also been made is a devasting and awkward killer in people and even though some has been put in policies efficient in tackling this, the world is met with dismal infrastructure or poor law enforcement.

Chakrabarti (2018) noted that the development of highways in India is beneficial for creating jobs, as a 10 % increase in the density of highways is associated with an increase in jobs in the private sector by 1–6 %.[8] A research by Murozi et al. (2022) shows that the International Road Assessment Programme (iRAP) managed to assess the very dangerous roads are formulated Safer Roads Investment and star rating Plans; as a result of this initiative, the number of traffics accidents was reduced.[9]

Bhatacharya and Kumar (2023) looked at the challenges that are preventing the spread of superbikes in India's market and stressed how poor road surfaces, heavy traffic, and lack of safety measures slow down the process.[10] In their view, these problems hinder the uptake and use of superbikes as well as create more risk for road accidents. The authors stressed that the condition of the strategic and the transport infrastructure in the regions, especially in big cities, creates situations which significantly raise the incidence of mishaps pertaining to the use of superbikes. This highlights how the road infrastructure, traffic management, and safety in those areas must improve before the risks to the public are reduced and road usage becomes safer.

Deka and Ranganathan (2023) emphasized that individual and institutional responsibilities must be clearly delineated in enhancing road safety in India.[11] They argue so because the allocation of these responsibilities is critical for the design of specific programs that would help in reducing fatalities and injuries on the roads. The study by Pampapathi et al. (2023) focused on the role of Road Safety Audits in the identification and rectification of design shortcomings related to highways.[12] It found that RSAs were instrumental in pinpointing where design flaws existed, which is the demande for amelioration of relacionado infrastructural changes plus network reliability overall.

The existing literature discusses general road safety programs and methodologies of collecting data with no

in-depth study on a proven outcome and impact of such programs within the Indian scenario. The paper aims at filling this gap by examining the effectiveness of iRAD and e-DAR in improving road safety in India.

METHOD

National Highways, being just 2,03 % of the overall road network of India, accounted for an excessive 35, 7 % of fatalities in 2019. Moreover, state highways, comprising 3,01 % of the total length of road, were responsible for 24,8 % of fatalities. State & national roadways constitute 5 % of the whole road network; however, they account for around 61 percent of unintentional fatalities. Other roadways, which make up 95 % of the total, are responsible for 39 percent of the fatalities.[13] An increase in accidents on roads may indicate a need for enhanced enforcement and modifications on National and State roads.[14]

iRAD Stakeholders

The World Bank funds the MoRTH for iRAD, a significant initiative that aims to scientifically address road accident issues by utilizing latest ICT techniques and tools in partnership with frontline workforce from accident management agencies.[15,16] The objective is to gather accurate road accident information from the incident site, incorporating complete information from the highway authorities, hospitals, police and transport department, to establish a comprehensive database that can be integrated with other stakeholders in the ecosystem, such as ambulance services, insurance companies, blood banks, CCTNS (Crime and Criminal Tracking Network and Systems), and motor accident claim tribunals.[17]

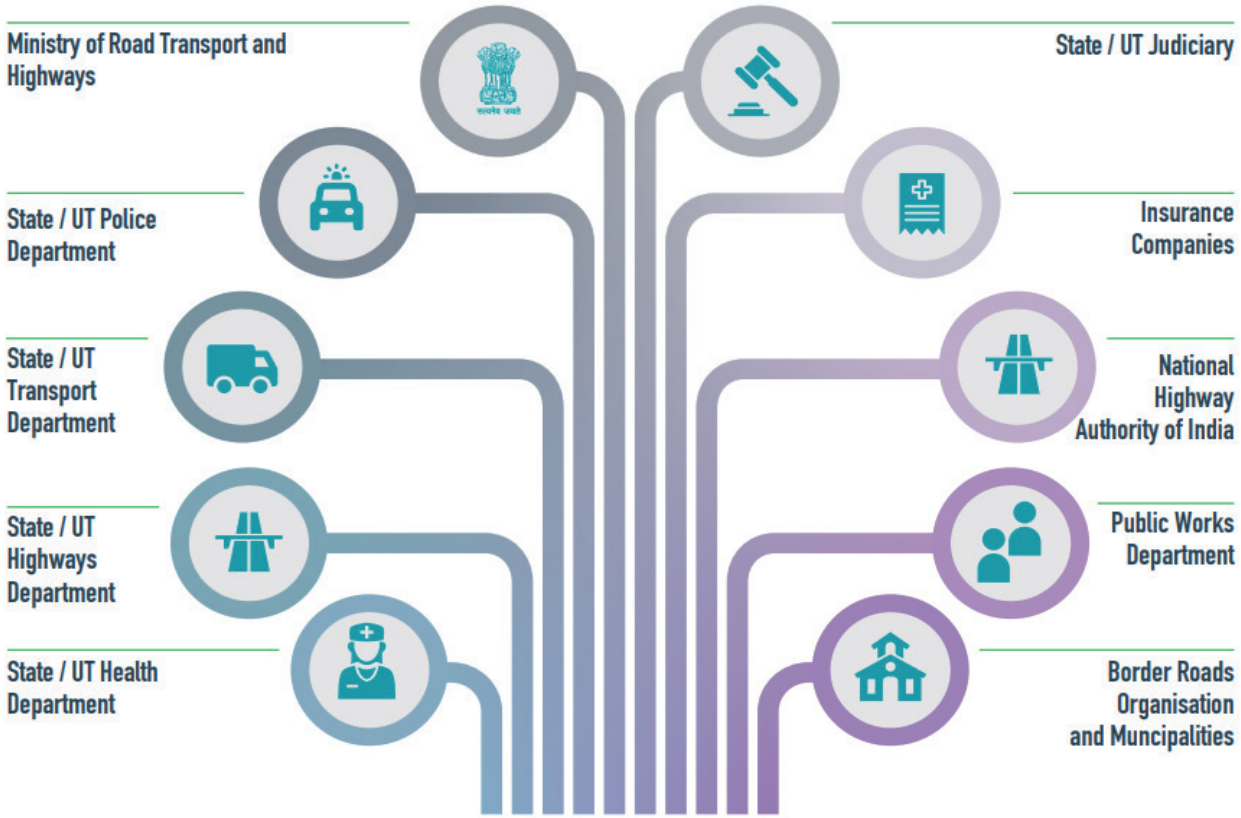

Figure 1. iRAD Stakeholders13

This ecosystem ensures accurate accident reporting with dependable documentation, enables thorough analysis for accident prevention, offers an expedited method for medical assistance, and accelerates claim resolution from insurance providers. NICSI (National Informatics Centre Services) and NIC (National Informatics Centre), in conjunction with IIT Madras, are executing the system nationwide.[18] The iRAD mobile and online applications are built by NIC Chennai and are distributed to all stakeholders, including staff from police stations, RTO (Regional Transport Office), hospitals, and others, as seen in figure 1.

Working of iRAD

The iRAD mobile application will allow police officials to input information on a road accident, including photographs and videos, after which a unique identifier will be generated for the occurrence. Thereafter, an engineer from the Public Works Department or the local authority will get a notification on his mobile device.

https://doi.org/10.56294/sctconf20251350

The individual will thereafter visit the accident scene, conduct an examination, and provide the necessary facts, including the road design.[19] The gathered data will be analyzed by a team from IIT-M, which will then recommend if remedial adjustments in road design are necessary (Luthra and Mangla, 2018).

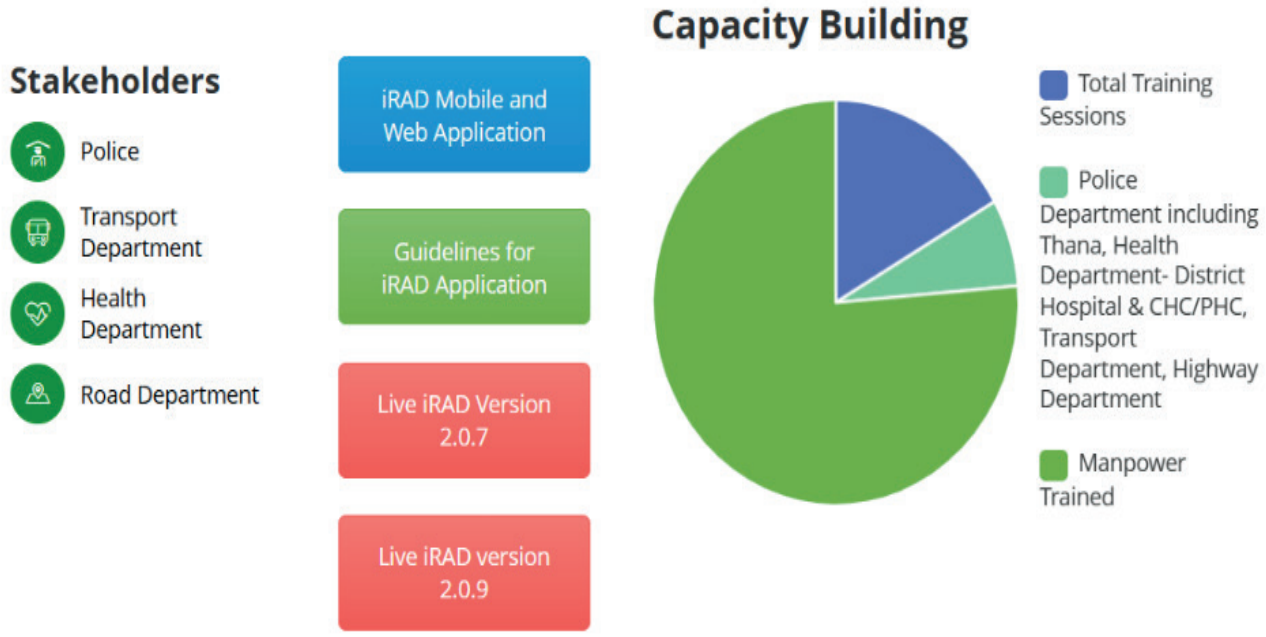

Figure 2. Capacity building

RESULT

Since its inception, 34 states and union territories have adopted the system incrementally. Over the period of one year the system has documented more than 340 000 accident instances involving 490 000 individuals. Of them, 108 000 are fatalities and 91 000 involve severe scratch. NICSI has assigned 737 roll-out managers at state and district level and facilitated around 40 000 training and support time at state, district and central levels, including over 228 000 participants. NIC and NICSI exert continuous efforts to include all states and stakeholders, aiming to render the system complete.[20]

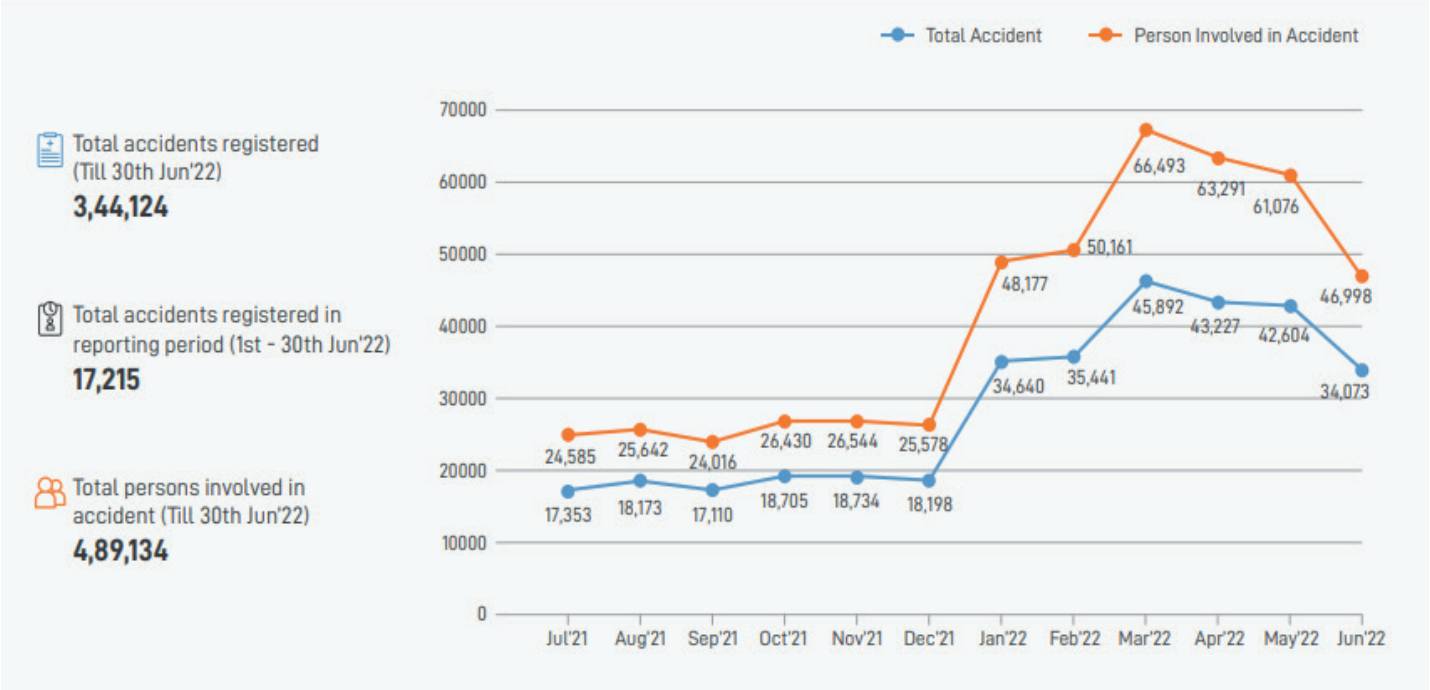

Figure 3. Accident Statistics

https://doi.org/10.56294/sctconf20251350

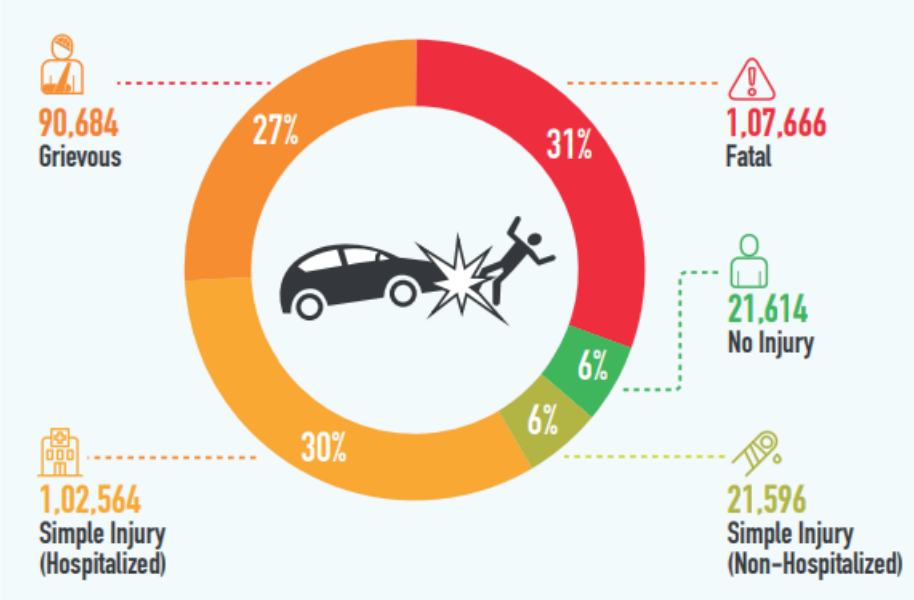

Figure 4. Accidents- Severity-Wise

The data gathered by iRAD will be analyzed with a sophisticated data analytics platform to identify accident-prone locations, blackspots, and other contributing factors, including road engineering deficiencies. The analytical result would enhance the administration of difficulty response systems and healthcare facilities for accident victims while also aiding policy and decisionmaking formation by pertinent authorities. The project's output is anticipated to improve road safety.

DISCUSSION

In compliance with orders of Honorable Supreme Court of India, the iRAD system is being augmented in its scope and functionality to include the process of accident claim settlement. The MoRTH has issued new regulations and a series of documents related to Accident Claims Settlement. The iRAD system is being transformed into eDAR (Electronic Detailed Accident Report system) and is undergoing modernization to enhance features for the police department and provide additional services for clients, including insurance companies and the Motor Accident Claims Tribunal (MACT).

The prototype system has been presented to the Honorable Supreme Court, and final testing and deployment of the system are now being prepared. Officials from NIC and NICSI at the central (Delhi and Chennai), state, and district levels are exerting maximum effort to guarantee the project's success. Upon thorough implementation of the system, it will enhance the management, analysis of accidents and their victims, and reporting ultimately contributing to a reduction in accidents and deaths.

Salient Features

- Systematic and consistent collection of road accident data throughout India.
- Workflow-based access for law enforcement and connectivity with the NCRB application for FIRs.
- Examination of accident-prone locations and the underlying reasons for the incident
- Records GPS coordinates of the accident location
- Enables the collecting of traffic accident information by the Transport, Police, Health Departments and Highways.
- Combination with external systems such as Vahan, CCTNS, Sarathi, EMRI, NHA and Map Services.

Challenges and Barriers

The MoRTH has faced several problems in the implementation of the iRAD and e-DAR programs, spanning technical, administrative, and social aspects. While these have in them the power to bring about betterment in road safety in India, their implementation and operational effectiveness get stuck with challenges that need to be addressed for the betterment of their performance.

Technological Barriers

The lack of technological infrastructure to support iRAD and e-DAR is the greatest barrier to implementation. In addition, the sharing of sensitive data about accidents, individuals involved in these accidents and ongoing investigations between different stakeholders such as law enforcement, hospitals, insurance companies and

https://doi.org/10.56294/sctconf20251350

government authorities has raised concerns regarding data security and privacy as well. It needs safe transport and storage of the data and it is still a technological miracle in the environment of India.

Administrative Barriers

The channelling of a collaboration among several entities involves some considerable administrative effort. The i-RAD and e-DAR institutes have, among others, law enforcement agencies, departments of transport, or highway authorities, medical institutions, and ambulance services as their partners. Each entity operates with its own systems and standards, making data integration complex. For example, police department accident reports may not regularly align with hospital records, and discrepancies in data submissions from many sources might compromise the quality and use of the database. The lack of uniformity in accident data reporting across states and union territories complicates the integration of data into a unified system. Disparities in regional formats and inconsistent execution of reporting mandates may lead to fragmented or incomplete datasets.

Social Barriers

Social barriers impede the effectiveness of iRAD and e-DAR. A significant barrier is the resistance to change among frontline workers, such as police officers and transport department staff, who are used to traditional accident reporting methods. Implementing new technology and digital systems often requires training and a shift in mindset, both of which need time and resources for effective implementation. In some cases, there is reluctance to adopt digital technology due to inadequate digital literacy or concerns over the complexity of new systems. Besides, public knowledge of the iRAD and e-DAR project is severely limited. Different categories of road users, such as those involved in accidents, may not entirely understand the relevance of these technologies in the promotion of road safety. Insufficient public information and educational outreach will prevent the projects from revising data reporting and optimizing the overall impact.

CONCLUSIONS

The paper gives a detailed analysis of the iRAD and e-DAR implemented by the MoRTH which is a step towards improving road safety which is one of the major problems in India. In India, road crashes continue to be one of the most public health issues in India causing the loss of many lives and injuries every single year. The iRAD initiative solves this problem by designing a comprehensive database that provides the allied authorities with accurate real-time information, hence facilitating proactive decision-making to enhance the road safety situation. e-DAR is also about speeding up the reporting process and improving accuracy, as it would provide in-depth information about the causes and trends of accidents. This research further was the result of these methods that improved accident data collection precision through data accuracy analytics and that enabled sound policy decision-making. The iRAD and e-DAR systems besides using current data analytics let the decision-makers narrowly point out the high-risk areas, and predict accident trends for them and also develop and execute corrective programs. The Monitoring & Reporting Dashboard and Analytics Dashboard offered the user a simple interface through which they can gain better visibility on the accident data, thus, supporting them in their decision to sustain national road safety improvements. The research found few restrictions in the implementation of various measures, such as technical factors like connection difficulties, regulatory issues between agencies, and societal objections to new digital reporting methods. Nevertheless, iRAD and e-DAR are still able to greatly contribute to road safety in India. The climbing of these hurdles and the constant victories depend on infrastructure development, educating stakeholders, and integrating varied data sources.

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FINANCING

No financing.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Gijja Srinivasa Rao.
Data curation: Gijja Srinivasa Rao.
Formal analysis: Gijja Srinivasa Rao.
Investigation: Gijja Srinivasa Rao.
Methodology: Gijja Srinivasa Rao.
Project management: Gijja Srinivasa Rao.
Resources: Gijja Srinivasa Rao.
Software: Gijja Srinivasa Rao.
Supervision: Gijja Srinivasa Rao.
Validation: Gijja Srinivasa Rao.

Display: Gijja Srinivasa Rao.
Editorial – original draft: Gijja Srinivasa Rao.
Writing – review and editing: Gijja Srinivasa Rao.

https://doi.org/10.56294/sctconf20251350