

Enhancing Road Accident Information Management through the Development of a Web GIS-based Road Accident Information System

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Abstract

Road accidents have become a significant issue worldwide, and they are a leading cause of death and injury. According to the World Health Organization (2024), approximately 1.19 million lives are lost annually due to road accidents. Globally, 20 million to 50 million people are injured, causing many to suffer permanent disabilities. In Sri Lanka, it is reported that 19.5 males out of 100,000 lose their lives annually due to road accidents. However, little attention is paid to enhancing road safety through GIS based tools in Sri Lanka. Road accident details are collected through the 297–B form by the Sri Lankan Police, and that data is then entered into the Modular Accident Analysis Program (MAAP) software. Even though the data collection systematically takes place, the limited use of data is observed, and its potential in the decision-making process is also neglected by employing data only for statistical purposes. The only method employed by individual police stations to identify high-risk locations and peak accident periods involves manually plotting accidents on physical maps and time charts. Additionally, the Modular Accident Analysis Program (MAAP) software previously used by the Sri Lanka Police suffers from significant limitations, including reliance on an outdated offline base map from 1999, which is incompatible with the current road network. Due to these technical inefficiencies and data reliability issues, the police discontinued the collection of geolocation data (East and North coordinates) for accidents after 2019. Accordingly, this study proposes the development of a Web GIS-based road accident information system, with the Mirihana Police Area serving as the case study location. The Web GIS-based system was developed using the ArcGIS Online platform, leveraging Survey123 for structured, field-based data collection and Web App Builder for creating interactive web applications without the need for coding. Survey123 was configured to capture detailed road accident information, including attributes such as date, time, location, type of collision, severity, and contributing factors. The survey form was optimized for mobile device usage, enabling real-time data entry by field officers. The collected data was automatically integrated into the ArcGIS Online environment, where Web AppBuilder was utilized to design a customized web application featuring dynamic maps, dashboards, and query tools. These tools allow users to visualize accident hotspots, filter data by time periods, and analyze spatial patterns interactively. The system architecture ensures centralized data storage, ease of access for multiple stakeholders, and supports decision-making through real-time spatial analysis and visualization. This system made the data insertion process significantly efficient, given the capabilities of Survey123, such as precisely locating accident locations through a mobile device or the web in real time. Efficient data filtering options greatly increased data retrieval, and the existing data downloading option made this system useful for research purposes. Furthermore, the availability of spatial statistical analysis tools such as Hot Spot analysis, Point Density analysis, Outlier analysis, and point cluster analysis makes decision making processes prompt, which enables the identification of concentrations of severe accident

locations, enabling authorities to organize mitigation strategies in a speedy manner compared to the use of manual methods. Ultimately, this Web GIS-based system not only improves the local-level accuracy and efficiency of accident data management but also serves as a decision-support tool for policymakers. Being modular in nature and easy to deploy, it is scalable to deploy in other police divisions of Sri Lanka, facilitating a more data-driven and proactive nationwide response to road safety.

Keywords: *accident information system, web GIS, spatial data analysis, road safety*

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