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Visibility Obstruction Due to Fog And Smoke

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ABSTRACT

Snow or rain-related crashes have been the focus of research on weather's impact. Unfortunately, crashes that happen in fog or smoke are not well understood (FS). This study uses Andhra Pradesh crash data from 2013 to 2020 to give a thorough analysis of FS-related crashes. In order to explore FS-related accident features in terms of temporal distribution, influential factors, and crash types and to estimate the effects of different factors on injury severity provided that an FS-related crash has happened, a two-stage research technique was used. The most frequent times for FS-related crashes are the early morning hours from December to February. FS-related collisions frequently involve more vehicles and result in more serious injuries than collisions that occur when visibility is clear. The most common types of collisions are head-on and rear-end collisions.

KEYWORDS: *Fog & Dew, Automobiles, Road Accidents, High Speeds, Visibility*

I. INTRODUCTION

The main goal of this work is to construct an accident likelihood prediction model for fog-related crashes on highways and to identify major factors that contribute to these crashes. Mean Decrease Accuracy was used to determine and rank the most crucial variables using the Random Forests approach (MDA). The Bayesian logistic regression model was then used to construct a real-time crash risk prediction model for motorways in fog. The processes of variable selection, model development, and model estimating are carried out using historical crash data, traffic flow data, and meteorological data. On the motorway, loop detectors and climatological stations collect real-time data, which is then fed into the established model to estimate the likelihood of traffic accidents in real time. The study's findings will help people better understand how traffic flow dynamics and crash risk differ when there is fog. It will assist transportation management in creating better fog-related crash prevention strategies. Unfavorable weather is regarded as a dangerous driving environment and can

significantly raise crash rates. One of the primary issues in safety management is the reduction in visibility brought on by fog. Although though the number of fog-related crashes is low, Andhra Pradesh nevertheless experiences 300–400 fatal fog-related crashes annually. In foggy conditions, crashes are frequently more severe and involve many vehicles.

II. DISCUSSION

This study examined the compliance level of fog warning systems at various technological levels in various foggy conditions using the CV testing platform, which is based on driving simulation technology. The purpose of compliance level evaluation is to improve the system's architecture in order to increase the effectiveness of the fog warning system.

Based on the findings of the careful analysis of compliance level, it is necessary to install and use the fog warning system in areas where fog is frequently present. Fog warning systems with HMI and DMS are more suitable for use on days with light fog, whereas fog warning systems with simply HMI are better suited for use on days with thick fog, depending on the level of compliance. Because drivers are more likely to rely on HMI in deep fog, improving DMS has less of an impact on them.

III. ROADWAY CHARACTERISTICS INVENTORY (RCI) DATABASE

All state roads in AP were considered for this study's inclusion. The Florida Department of Transportation's Accident Analysis and Reporting (CAR) system database was used to extract all crash data for these state roadways. The Roadway Characteristics Inventory (RCI) database was used to gather information on road characteristics. Both the corresponding RCI data for each crash site and crash data from 2003 to 2007 were examined. These two databases were combined based on the distinctive roadway identifiers that they both used. As a result, the final database had several traits that could be connected to each distinct crash.

IV. CRASH CHARACTERISTICS ANALYSIS

FS causes vision blockage at various times of the day and in various seasons. As a result, the season and time of day have an impact on the crash frequencies under these circumstances.

Therefore, it is important to take into account how FS-related accidents are distributed across time. As can be seen, several crashes occur throughout the early morning and the hours that follow that are triggered by FS (particularly between 5am and 8am). However, the months of may.

December through February are connected with a large frequency of crashes that are FS-related when looking at the monthly changes in these crashes. It's noteworthy to see that the crash

frequency trend suddenly increases in the month of May.

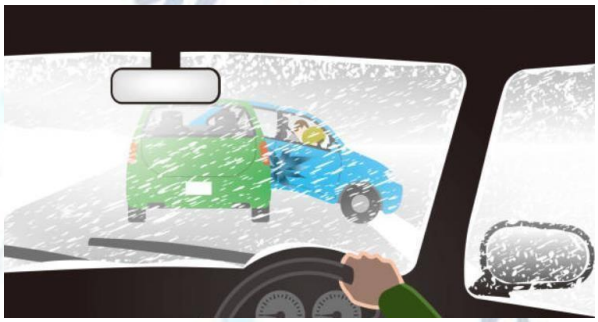
In conclusion, from December through February, the most frequent times for FS-related crashes are between the hours of 5 and 8 in the morning.

Various variables (such as the road, the driver, and the surroundings) may have direct or indirect effects on the frequency of crashes involving FS. In this investigation, the frequency of FS-related crashes under various circumstances is compared to equivalent CV crashes to identify the key variables influencing FS-related crashes. Figure illustrates how several factors affect FS-related crashes in comparison to CV crashes.

V. REVIEW OF THE LITERATURE

Various variables (such as the road, the driver, and the surroundings) may have direct or indirect effects on the frequency of crashes involving FS. In this investigation, the frequency of FS-related crashes under various circumstances is compared to equivalent CV crashes to identify the key variables influencing FS-related crashes. Figure illustrates how several factors affect FS-related crashes in comparison to CV crashes.

Many elements influence the indicators, according to the findings of the analysis of the influencing factors and mechanisms. The shift in the speed indication brought on by declining visibility is the most visible of the components, which are all indices of the response degree. A clear and complete warning information system design is crucial since the study also indicated that the degree of the driver's awareness of the DMS and HMI influences which signs have a meaningful impact. The authors propose that in the future, a technological acceptance model (TAM) of the warning system might be utilised to evaluate the driver attitude, perceived usefulness, and usability of the warning system.



VI. PRECAUTIONARY MEASURES

This behavior could be explained by the possibility that, under specific circumstances, lessening the headway with the lead vehicle could result in a perceptual benefit. Moreover, it has been attributed to driving illusions of risk. The fog situation raises the perceived risk of the environment owing to ambiguity, result in drivers reducing space headway to attain a greater feeling of safety. As a result, the shorter headway in foggy conditions could not be primarily attributable to the fog's effect on lowered speed; rather, it was likely caused by drivers' subjective feelings of decreased safety.

(i) Driver attributes (e.g., age)

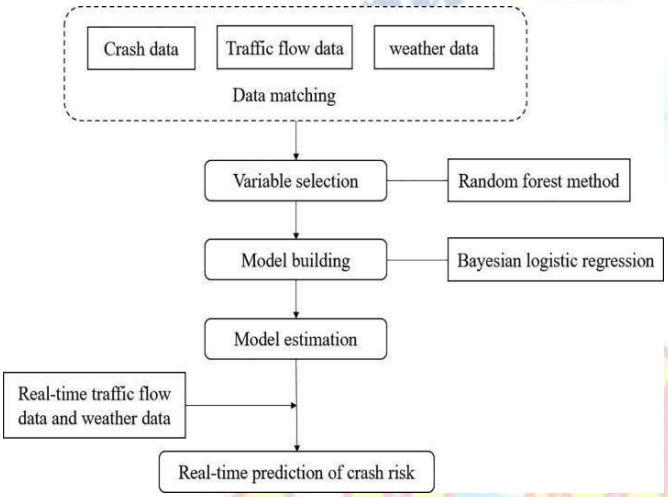
(ii) Roadway attributes (such as posted speed limits and divided/undivided roads).

(iii)Environmental characteristics, and (e.g., weather conditions and visibility conditions).

VII. CONSEQUENCES

The FS-related crashes were specifically extracted based on a variety of characteristics to guarantee that only accidents that occurred in foggy or smokey conditions, without any other weather conditions, were chosen. "Weather condition" served as the primary filter variable, and "visual obstruction" served as the secondary filter variable. Because of this, FS

crashes do not involve other elements that decrease visibility, such as heavy rain, the sun, or headlight glare. As a result, 994 crashes that were connected to FS were discovered between 2003 and 2023. We grouped crashes caused by smoke and fog because they both might result in sight obstacles. There is no information on the level of visibility for smoke or fog in the CAR or RCI databases.



VIII. CONCLUSION

This study provides a comprehensive framework for evaluating the degree of adherence to fog warning systems at different technology levels. In addition to evaluating the compliance level of the fog warning system, the evaluation technique can also be utilised to evaluate the compliance levels of other CV warning systems. The results of this study can be utilised to improve the architecture of fog warning systems, hence boosting their performance. Also, based on driving simulation, this study provides general techniques and research ideas for the compliance level test of the warning system in CV circumstances. In next investigations, the authors will classify different CV warning systems according to their characteristics and functionalities and develop a system for measuring drivers' compliance levels in an effort to raise their level of compliance while maintaining safety.

Driving under risky circumstances. As a result, examining the time distribution of FS-related accidents is useful. As shown, the early morning and the hours that follow are when crashes brought on by FS occur most frequently (particularly from 5am to 8am). While examining monthly variations in these crashes, it is also known that the months of December through February have a high percentage of FS-related crashes.

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