Enhancing Road Safety in Chennai: Insights and Causes from ADAS Alerts Analysis

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ABSTRACT

This study is centered on an analysis of alerts generated by the Level-2 Advanced Driver Assistance System (ADAS) installed in public buses operating in Chennai, India. The study focuses on unraveling the insights gained from these alerts and uncovering potential root causes. These causes encompass a broad spectrum, ranging from issues related to city and road planning to their associations with time-based events. This analysis aims at bridging the gap between operations and on-ground effects and focuses on enhancing road safety in Chennai. The prescriptions given are not restricted to a particular city but can be referred to as standard requirements for any city/road planning project. This report will serve as a referential resource for policymakers seeking to address the city's complex issue of road safety.

INTRODUCTION / MOTIVATION

Chennai, known for having the highest number of road accident-related fatalities, serves as a glaring reminder of the urgent road safety challenges facing the nation. It is imperative to scrutinize the factors contributing to this grim reality. The deployment of Level-2 Advanced Driver Assistance Systems (ADAS) in public buses presents a pivotal opportunity to address these concerns.

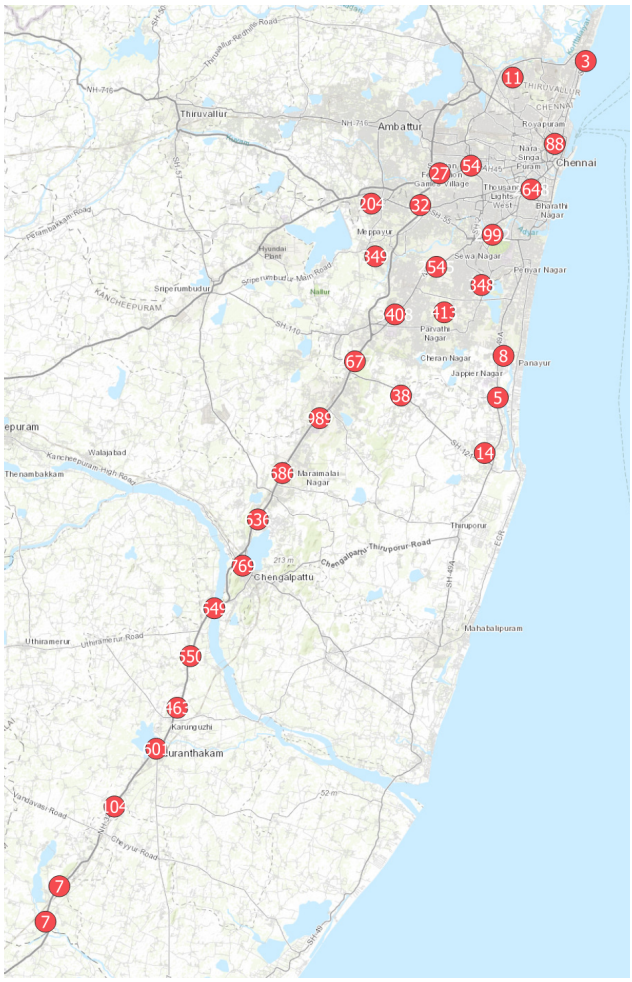
This report conducts a comprehensive analysis of data generated by the ADAS system in Chennai's public buses, seeking to unravel the myriad of alerts produced and their underlying causes. By dissecting the alerts, we aspire to facilitate informed decision-making and formulate effective strategies geared towards reducing road accidents and saving lives in Chennai, thereby contributing to the ongoing efforts to enhance road safety in this vibrant and densely populated city.

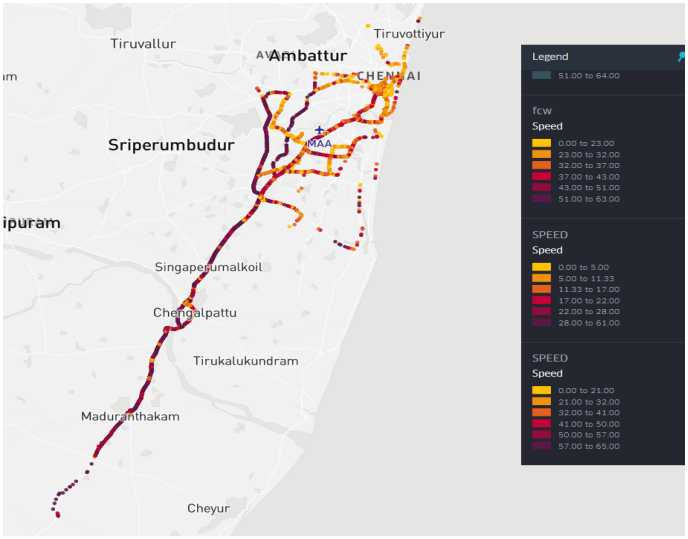
DATA SOURCES

1. ADAS dataset provided by Intel Unnati (Primary)
2. Secondary Source:
    - Ministry of Family and Health Welfare, Press Release by PIB Delhi, 27th Feb 2021 [2]
    - Indian Movie Theatre dataset [3]
3. Software used:
    - Kepler.gl
    - QGIS
    - Python- Pandas

ANALYSIS – Patterns and Insights

1. Congestion Hot-spots

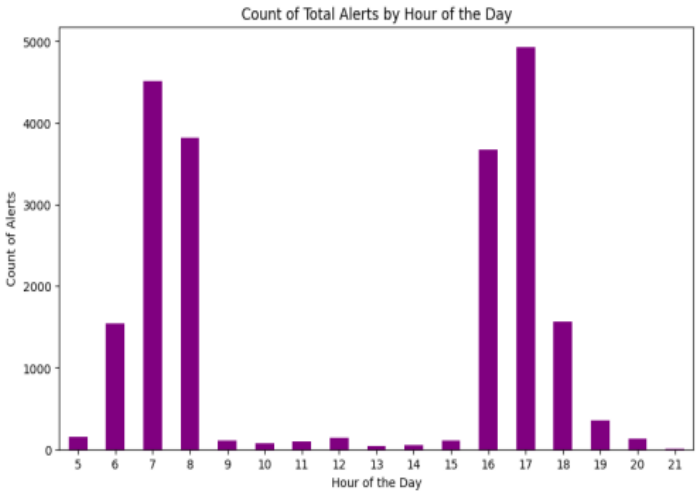




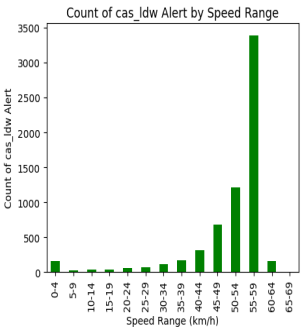
Clusters of data within the analysis highlight consistent patterns of warning alerts occurring either at **"Roundabouts"** or near **"Highway Exits"**. Also, it is clearly visible that vehicle speeds are considerably high on the national highway and also indicates that there is a lack of smoothness in taking an exit which might be due to poor conditions or narrow exits. Identifying these problem areas will allow authorities to focus on critical areas for targeted road safety improvement drives.

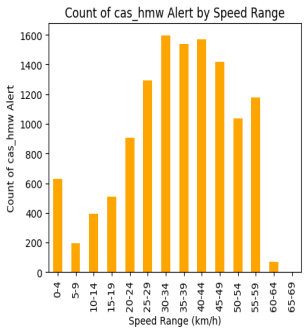
2. By hour

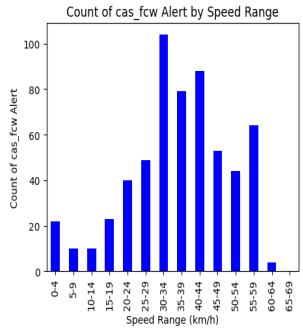
The data analysis indicates that most alerts occur during the morning (6-8 AM) and evening (4-6 PM) rush hours. These time frames coincide with high traffic volumes, rush hours, congested roads, and increased stress levels for drivers, leading to a higher frequency of alerts. Recognizing this temporal pattern is vital for developing specific road safety strategies during these critical hours.

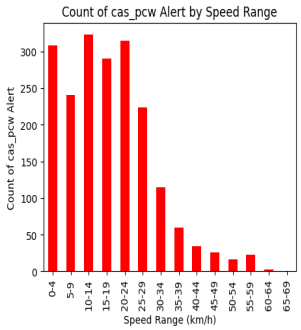


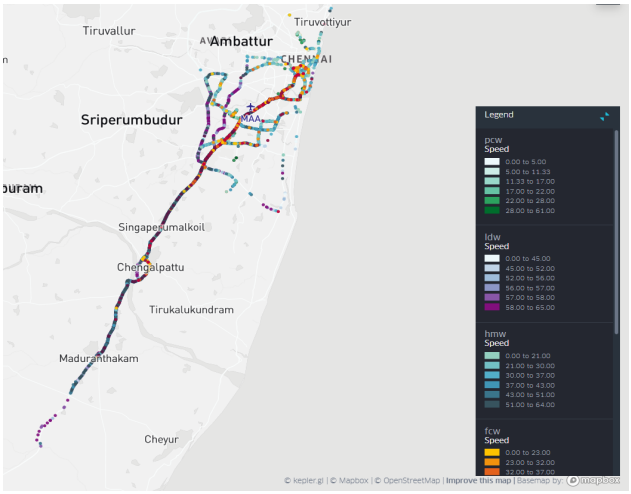
3. Speed range and verification map











The analysis of the ADAS system data indicates that lane departure warnings (**cas_ldw**) are more common at high speeds, suggesting regular **lane drifting on the NH-32**.

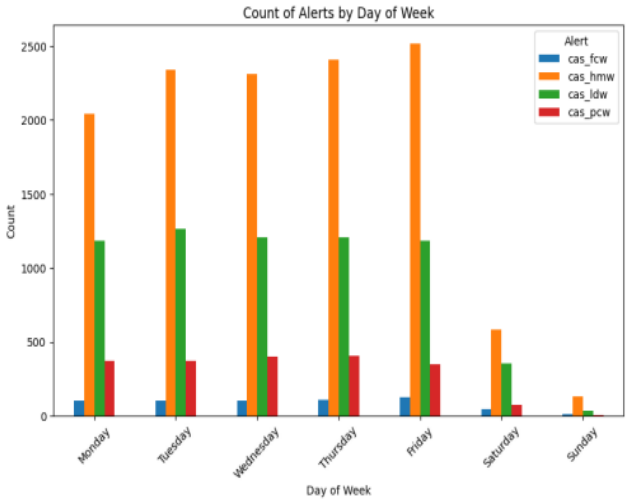
Pedestrian warnings (**cas_pcw**) occur at lower speeds, which are concentrated on the **bypass roads and city roads**.

We can also see that forward collision alerts (**cas_fcw**) are constantly high at every speed range which also indicates the "**Tailgating**" driving style of residents.

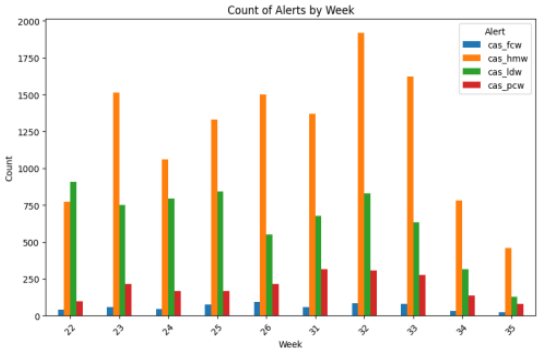
All the specified insights can be well driven from charts and also **verified from the map** specified.

4. Day wise analysis

As expected, we can see a predominant occurrence of alerts from Monday to Friday. This trend aligns with the typical workweek, where commuter traffic and daily routines contribute to higher alert frequencies during these weekdays. Understanding these patterns can contribute to variable rules in this duration.



5. Weekly analysis



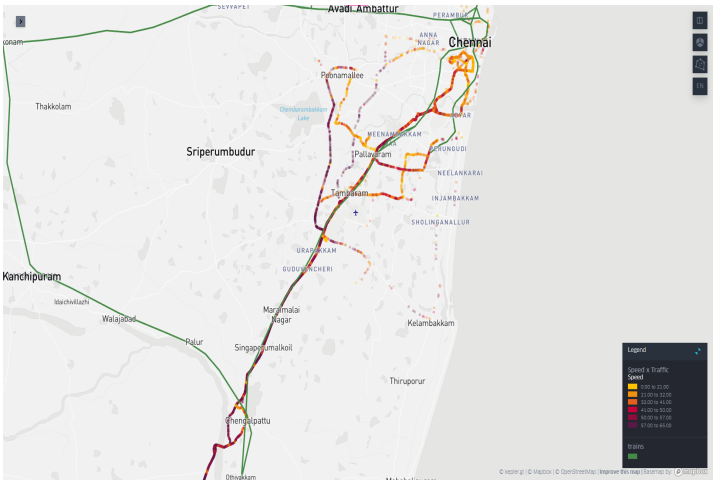
The graph provides a visual representation of how alerts are recorded over a span of weeks. It has been observed that the number of alerts stays fairly constant, but tends to reduce in the near end of the 2nd month, showcasing the change in traffic flow and congestion over a period of 2 months.

6. Other Causes

Another main reason for congestion is the large **number of railway stations** and a railway path parallel to the road as seen in the given map. The railway crossings, if at the same level, would cause more congestion [1].

It is also due to the huge number of **hospitals** and theaters located near the upper half of the map.

Other causes can include a higher number of parks, entertainment hubs, industrial hubs close to highways, etc.



Abbreviations:

CAS_HMW	Collision Avoidance System - Headway Monitoring and Warning
CAS_LDW	Collision Avoidance System - Lane Departure Warning
CAS_PCW	Collision Avoidance System - Pedestrian Collision Warning
CAS_FCW	Collision Avoidance System - Forward Collision Warning

REFERENCES

1. Guzman, William & Young, Leslie & Peszynski, Konrad. (2018). Addressing the cause of the problem and not its symptom: Road congestion at Railway Stations.
2. https://pib.gov.in/PressReleasePage.aspx?PRID=1701407
3. https://github.com/HarshaDevulapalli/indian-movie-theatres#data