Michigan Sate Road Accidents Data Visualization

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***Abstract*—This paper presents a data visualization of Michigan State Road Accidents for the year 2020. The raw data were first gathered from various sources and organized, cleaned, pre-processed, and finally, visualizations were performed to bring out the various findings. The purpose of this study is to identify trends and patterns in road accidents from the years 2010 to 2021, analyze the safe time and day to travel on Michigan roads, identify the accident prone counties in Michigan to help the Michiganders and lawmakers to make informed decisions regarding road safety. The data used in this study was obtained from the Michigan Department of Transportation (MDOT), Michigan Traffic Crash Fact (MTCF) and includes various attributes such as the type of accident, the location, the time of day, and the severity of the accident.**

Keywords—Road accidents, fatal crashes,

I. INTRODUCTION

According to World Health Organization, every 24 seconds, a life is lost on the road, and it costs countries around 3% of their gross domestic product. Traffic rules and systems are built by the government for its citizen for a quick and uninterrupted movement with ease of accessibility. However, if the road regulations are not followed correctly it may result in unexpected crashes or consequences as a loss to the community and human lives. According to Michigan Traffic Crash Facts Every 2 minutes and 9 seconds a traffic crash occurred [4].

Road accidents have been a major concern for many states in the US, including Michigan. According to the Michigan State Police Traffic Crash Facts, in 2020 alone, there were a total of 245,432 traffic crashes reported in Michigan, resulting in 44,417 personal injuries and out of which 1010 were fatal crashes [4]. The cost estimate for Michigan crashes in 2020 was $41,808,241,500. This estimate is based on the National Safety Council's cost estimating procedures [4]. If costs were spread across the state's population this would translate into a loss of $4,195 per state resident [4]. These alarming statistics highlight the urgent need to understand the causes and patterns of road accidents in Michigan to develop effective strategies for reducing their occurrence and severity.

II. DATASET

The dataset used for this visualization was collected from various resources such as Michigan State Police Department, Michigan Traffic Crash Fact (MTCF) and the Michigan Department of Transportation (MDOT). The raw data first collected from these sites and organized, cleaned, pre-processed as per the research questions to perform the visualization.

III. PREVIOUS WORK

In the "Road Traffic Accident Data Analysis and Its Visualization" by Muhammad Babar Ali Rabbani, Muhammad Ali Musarat, Wesam Salah Alaloul, Ahsen Maqsoom, Hamna Bukhari, and Waqas Rafiq research the Visualization was performed on Road Traffic Accidents data in the Hayatabad area, Pakistan, using Python programming language software that helped the researchers interpret the important information and devise effective prevention and safety measures to avoid the huge number of Fatal crashes and Fatalities in the future. The visualization consists of four major steps they are: Collection of Raw data from various sources such as GPS data, official local department statistics, or the incident logs, preprocessing the raw data by converting the data into temporal properties, making use of the visual symbols and icons like bar and line chart and finally the visualization was created by using Info-graphics and maps. The research has provided information about the Fatal Accident time, Literacy of the driver, Gender, Vehicle type, and deaths per year driving out the insight that the most Fatal accidents happened in the daytime and the year 2020. Similarly, the research also focuses on the nature of the injury, non-fatal/non-injury accidents, and indicates the major hotspots where the highest number of accidents has taken place using the cartographic representation which was developed by using software [1].

Another study "Road Accidents in the UK (Analysis and Visualization)" by Anjul K. Tyagi, Ayush Kumar, Anshul Gandhi, and Klaus Mueller presents a comprehensive analysis of road accidents in the United Kingdom through the use of data visualization techniques. This research highlights the complex nature of road accidents in the UK, and the need for a multi-faceted approach to addressing them. The authors suggest that data visualization techniques can play an important role in understanding the causes and patterns of accidents, and in identifying potential interventions to reduce their occurrence [3].

IV. METHODOLOGY

1. Data Collection: The first step was to collect data on road accidents in Michigan State from the available sources. The data was obtained from the Michigan State Police Traffic Crash Reporting Unit, Michigan Traffic Crash Fact (MTCF) for the period of ten years from 2010 to 2021.

2. Data Cleaning and Pre-processing: The collected data was then cleaned and pre-processed to ensure

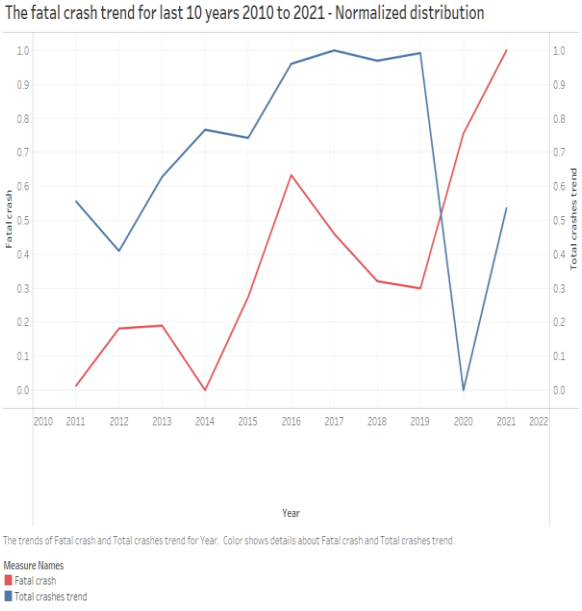
that it was consistent and ready for analysis. This involved identifying and correcting errors, removing duplicates, and filling in missing values.

3. Data Analysis: The cleaned and pre-processed data was analyzed to identify the trends in accidents and fatal crashes over the 10-year period. Min-Max normalization was performed on this dataset. This involved calculating the number of accidents and fatal crashes per year and identifying any significant changes or pattern

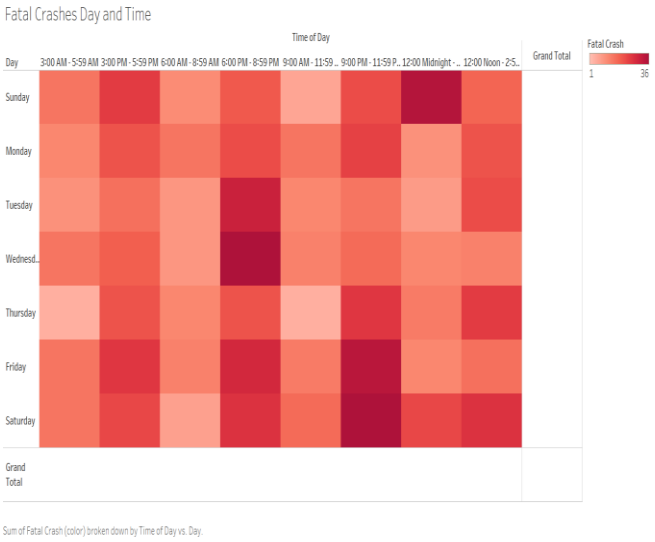
4. Data Visualization: The results of the data analysis were then visualized using appropriate visualization techniques to effectively communicate the trends identified. For example, line graphs and bar charts were used to represent the number of accidents and fatal crashes over the years.

V. RESULTS AND DISCUSSION

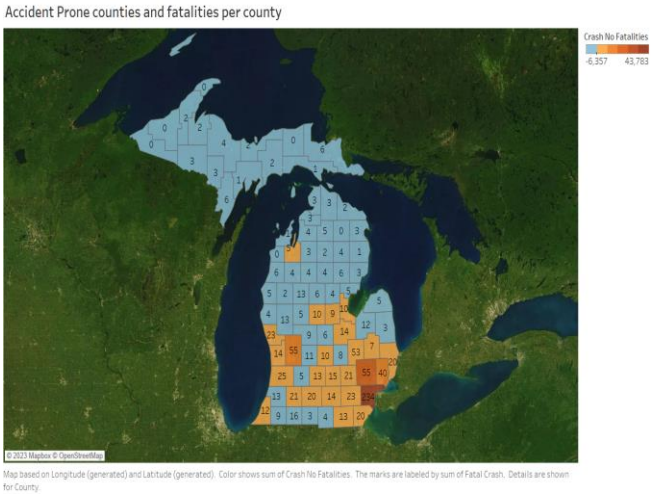
1. What is the overall pattern for crashes involving and casualties in Michigan over the last ten years, from 2010 to 2021?
The multiline chart is created to show analyze the trend in the traffic crashes and fatal crash for the past ten years. X-axis shows the years and Y-axis shows the normalized distribution for fatal crash and traffic crashes. Red line shows the trend in the fatal crashes whereas blue line represents the traffic crashes.



2. Identification of Safe Time and Day of Week to travel: The data was analyzed to identify the safe time and day of the week to travel on Michigan roads. This involved identifying the days and times of the week with the lowest number of accidents and fatal crashes.



3. Identification of Accident-Prone Counties: The data was analyzed to identify the counties with the highest number of accidents and fatal crashes. This involved calculating the number of accidents and fatal crashes per county and identifying the top 10 counties with the highest number of accidents and fatal crashes.



VI. CONCLUSION

IN CONCLUSION, THIS PAPER AIMED TO VISUALIZE THE TRENDS IN ROAD ACCIDENTS AND FATAL CRASHES IN MICHIGAN OVER THE PAST 10 YEARS, IDENTIFY THE SAFE TIME AND DAY OF THE WEEK TO TRAVEL ON MICHIGAN ROADS, AND HIGHLIGHT THE ACCIDENT-PRONE COUNTIES IN MICHIGAN. THE DATA ANALYSIS AND VISUALIZATION REVEALED IMPORTANT INSIGHTS THAT CAN INFORM POLICY AND DECISION-MAKING RELATED TO ROAD SAFETY.

FIRSTLY, THE VISUALIZATION OF THE 10-YEAR TRENDS IN ACCIDENTS AND FATAL CRASHES SHOWED THAT THE NUMBER OF ACCIDENTS AND FATAL CRASHES HAS INCREASED OVER THE YEARS, THE NUMBER OF FATALITIES

REMAINS A CONCERN, AND MORE EFFORTS ARE NEEDED TO REDUCE THE NUMBER OF FATALITIES ON MICHIGAN ROADS.

SECONDLY, THE ANALYSIS IDENTIFIED THE SAFEST TIME AND DAY OF THE WEEK TO TRAVEL ON MICHIGAN ROADS. BASED ON THE DATA, IT IS RECOMMENDED TO AVOID DRIVING ON WEEKENDS AND DURING RUSH HOUR PERIODS, AS THESE WERE FOUND TO BE THE BUSIEST AND MOST DANGEROUS TIMES ON MICHIGAN ROADS.

LASTLY, THE VISUALIZATION OF THE ACCIDENT-PRONE COUNTIES IN MICHIGAN HIGHLIGHTED THE NEED FOR TARGETED INTERVENTIONS IN THESE AREAS TO IMPROVE ROAD SAFETY. THE DATA CAN INFORM MICHIGANDERS, POLICE DEPARTMENT, INSURANCE PEOPLE AND TRANSPORTATION POLICYMAKER ON WHERE TO FOCUS THEIR EFFORTS IN REDUCING ACCIDENTS AND FATALITIES ON MICHIGAN ROADS.

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