Casulaities Prediction for controlling traffic system using fuzzy base controller

Dr. Vinay Chavan[1], Dr. Vilas M. Thakare[2], Sonali Umakant Gorade[3]
[1]S.K. Porwal College Kamptee, Nagpur, India
[2]Department of Computer Science & IT, SGB Amravati University, Amravati, India
[3]Research Scholar
(E-mail: drvinaychavan@yahoo.com)

Abstract— The proposed research is regarding designing and implementation of the system which helps for traffic management by predicting the number of causality. There are two main aims of this research. The first aim is to develop a multi criteria analysis model for better road network planning, which is suitable for situations found in developing countries such road accident ratio; three important keys in the model development are criteria determination, valuation of alternatives with respect to criteria and valuation of criteria weights. Second is to develop model for the detecting road casualty with respect to metro city for predicting the traffic condition which help it solve various similar problem and keep account the effects of road network conditions on transport demand. The compatible with local situations was also the part of the study; the transport demand models developed can be applied in situations where origin destination matrix is both available and unavailable.

Keywords—*AI, Casualty,Control, Fuzzy; Spatial Data;*

I. INTRODUCTION

Traffic management is a key problem for almost all the developed and under development counties [1],[2]. The proposed research work directs in the area of traffic management with respect to two major domains, it uses the concepts of control system [15] to understand the problem of traffic management and it uses the Fuzzy and control based system to solve issues related to traffic management[16]. Here AI (Artificial Intelligent) places important role. The problem was identified and was designed by simulation and traffic data sets which will be used for identifying the traffic issues. The research was designed to considered from AI based study for studying and secondary data will be captured from the analysis done by them in similar areas from published literature, white papers and articles. The primary data will be taken from the reports / estimates of planning unit of Metro City Transport. The data will include the estimated population of the study area, land use, and road network. The designed problem was on the basis of Pune City, here, the city was divided into 16 region and various data was collected and predicted using spatial data analysis. The traffic data was available for 2017-18 from various available data sets. The data related road was estimated based on various methods. As the data set is available it helped to maintain inputs in accordance with the system and identify to solve various issues in the same domain. The primary and secondary data will be simulated for road casualty detection and its prediction based on Fuzzy and control based model. For such simulation, dynamic programming methods etc. was used for initial solution. AI Algorithms was used for optimizing the initial solution.

II. LITERATURE REVIEW

The following literature review table helps to identify major issues of traffic and traffic management.

Table 1 Related References

Sr. No	Types of Issue	Related Reference No.
1	Traffic Management	1,3,4,7,10,11,12
2	Pollution	2,11,12
3	Crime control	5
4	Navigation	8,12
5	Congestion	10,11,13
6	Resource management	12
7	Disaster Management	3,6,9

Based on the above table it was identified traffic control is the major key challenge that need to be resolved and to look into, so the proposed research was related to the problem addressed.

III. ALGORITHM DESIGNED

The following section is about the proposed work, which is related to Fuzzy model and use of control theory for traffic management. Following is the algorithm designed for the experimental work proposed.

STEP 1.   Initialization

STEP 2.   Setting up environment and variables

STEP 3.   Read the data

STEP 4.   Merge the two or more datasets

STEP 5.   Cleaning the data

STEP 6.   Part 1: create date and time variables

STEP 7.   Cleaning the data

STEP 8.   Part 2: reliable categories

STEP 9.   Cleaning the data

STEP 10.   Part 3: create casualty age bands

STEP 11.   Calculate summary statistics

STEP 12.   Fuzzifier

STEP 13.   Production Rule

STEP 14.   Aggregation

STEP 15.   Defuzzification

STEP 16.   Computing bar charts

STEP 17.   Computing box plot

STEP 18.   Computing line chart

STEP 19.   STOP

IV. DESIGNED SYSTEM

The following diagram is the block diagram of the proposed research work , which is the experimental designed, which is about the Fuzzy and control based model for identification and prediction of the Traffic Based road spatial data Model.
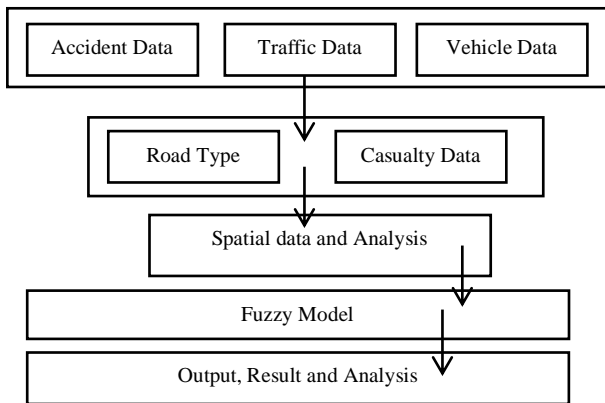

Figure 1. Designed System

Step 1 − Define linguistic variables and terms

Linguistic variables defined for the proposed work are input and output variables in the form of simple words or sentences. The defined terms are with respect to pune region traffic data based on various traffic conditions and the prediction is the output.

Traffic condition (t) = {very good, good, normal, bad, very bad}

Every member of this set is a linguistic term and it can cover some portion of overall traffic values.

Step 2 − Construct membership functions

Step 3 − Construct knowledge base rules

Create a matrix for different traffic condition values versus targeted traffic values that the system is expected to provide.

Table 2 Knowledge Base Rules Set

Traffic Condition	Very Good	Good	Normal	Bad	Very Bad
Very Good	No_Change	High	High	High	High
Good	Low	No_Change	High	High	High
Normal	Low	Low	No_Change	High	High
Bad	Low	Low	Low	No_Change	High
Very Bad	Low	Low	Low	Low	No_Change

Build a set of rules into the knowledge base in the form of IF-THEN-ELSE structures.

Step 4 − Obtain Fuzzy and control values

Fuzzy and control set operations perform evaluation of rules. The operations used for OR and AND are Max and Min respectively. Combine all results of evaluation to form a final result. This result is a Fuzzy and control value.

Step 5 − Perform defuzzification

Defuzzificationis then performed according to membership function for output variable.

Table 3 Knowledge Base Rules Set

Sr. No	Location Name	Region No.
1	Bajirao Road	R-1
2	Shivaji Road	R-2
3	J. M. Road	R-3
4	F. C. Road	R-4
5	Shankarshet Road	R-5
6	Solapur Road	R-6
7	Satara Road	R-7
8	Sinhagad Road	R-8
9	Karve Road	R-9
10	Baner Road	R-10
11	Aundh Road	R-11

| 12 | Ganeshkhind Road | R-12 |
13	S. B. Road	R-13
14	Old Mumbai-Pune	R-14
15	Alandi Road	R-15
16	Nagar Road	R-16

V.   RESULT AND ANALYSIS

This section presents the results of spatial data analysis and the designed models which aimed to investigate the effect of traffic congestion on the severity of accidents. As discussed in Section the results and analysis section can be categories in the following two types for the designed model namely ordered response models and unordered nominal response models, and these have been considered and tested. The section covers the Fuzzy and controlmodel designed and tested in order to produce the better response of the designed model.   The following section is organized by taking the results and findings from ordered response models are presented from the nominal response models as an alternative modeling approach. Finally, the model estimation results and findings are summarized at the end of the section. The following results can be concluded based on the designed experimentation

Table 4: Casualty Current Observation (2017-18) R^2 Value

Pedestrian	Bicycle	2 Wheeler	4 Wheeler	Bus / Trunk Auto	R^2 Value
5700	4350	5256	11980	2200	0.0538

Table 5: Casualty Prediction (2018-19) R^2 Value

Pedestrian	Bicycle	2 Wheeler	4 Wheeler	Bus / Trunk Auto	R^2 Value
6600	5230	5560	13030	2309	0.0922

Current
$y = 6656.7e^{-0.089x}$
$R^2 = 0.0538$

Observed
$y = 8073e^{-0.119x}$
$R^2 = 0.0922$
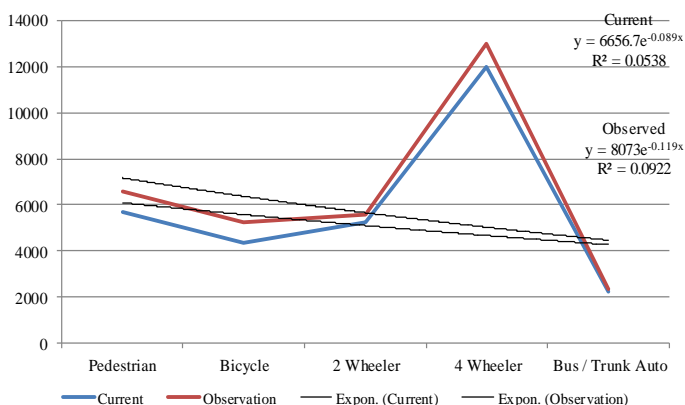
Graph 1. Vehicle type and casualty prediction

Based on the values computed by the designed system it was observed that the regression values for exponential curve plotted helped in better understanding of the system. It was understood by that the designed system helped to predict casualty for the coming year, but the values predicted are more stable for the existing system when it computed by vehicle type, as the r square value is more not near to 1 for the observed system when compared with the designed system

Current
$y = 2157.3e^{0.0181x}$
$R^2 = 0.3699$

Observation
$y = 2372e^{0.010x}$
$R^2 = 0.337$
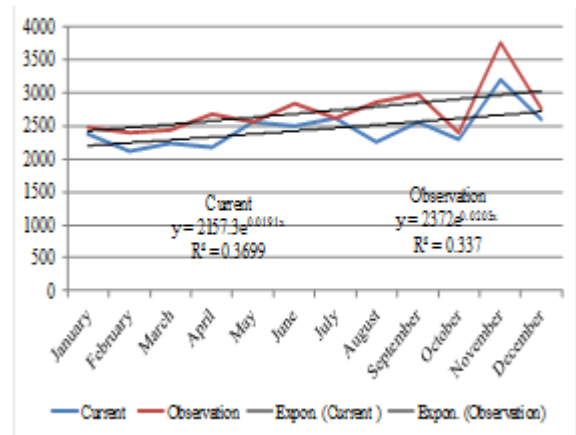
Graph 2: Month wise casualty prediction

Table 6: Casualty Prediction (2018-19) R^2 Value

Month	Current Observation	Perdition
January	2380	2480
February	2105	2405
March	2229	2429
April	2180	2680
May	2560	2560
June	2500	2843
July	2606	2606
August	2254	2854
September	2564	2979
October	2302	2387
November	3203	3750
December	2603	2756
R^2 Value	0.3699	0337

Following are the conclusion remarks

(1)   The effect of traffic congestion on road accidents based on different data
(2)   The designed system help to predict casualty data monthly

Considering the first observation, this thesis has explored to identify various relationship between spatial data, this relationship have gain to identify a variety of knowledge that leads to road casualty and traffic data. The thesis more specifically, help to predicts the accident frequency analysis, the thesis has found that traffic congestion increases the frequency of fatal and serious casualty and road.

- Compared to other modes of transportation ,4 wheeler was the maximum in terms of the accidental vehicle and was the major cause of traffic for road for day and night condition.
- The fuzzy and control system based system designed helped to evaluated and was part of the major contribution of the thesis.
- The data set used for the designed system was for pune region which is one of the most populated city of the county and part of Pune region was divided into 16 different region.
- The transportation and casualty data for properly examined with the help of the proposed algorithm and later results have are computed accordingly
- Graphs are plotted using the R Programming Language and which helped in proper presentation of the designed work
- It was identified that the data was classified and will versed with the derived experimentation and help to categories into various groups
- This has been predicted by using the fuzzy and control system based system and properly evaluated in the designed system

VI.　Conclusion

The following section was about an introduction to Traffic problem and covered the designed objectives for the study. Traffic and transportation problems in medium sized cites of many developing countries have become grave matters of concern to the governments as well as the private organization. The growing population was a part of observation and has been identified with a rapid growth and prime reasons for these problems. While the problems of larger metropolitan cities are at least taken note of and those of medium sized are not even recorded. A strategic planning of transport systems will alleviate these problems to a greater extent. Transportation planning process consists of analysis of interaction between supply in the form of existing facilities and the demand in the form of traffic load

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