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GAME ANALYSIS OF DRIVING BEHAVIOUR IN MIXED TRAFFIC

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Abstract:

In this paper, it is aimed to project various permutations & combinations in respect of "THE DRIVER" with a transport vehicle including other vehicles, the behaviour characteristics have been projected under various situations. The alertness of driver is very important. He should have a clear vision about the road map; the time may be day or night, now a day a good number of accidents are being made in the drunken stage of the drivers. It shall be included in road conditions as well as vehicle conditions also.

Keywords — game, driving behaviour, mixed traffic, condition of the driver, transport vehicle, clear vision, road map.

I. INTRODUCTION

At the outset, let us observe the title of the topic, "GAME ANALYSIS OF DRIVING BEHAVIOR IN MIXED TRAFFIC". Thus, it is to be noted for any mixed traffic either urban or rural, it is important to observe and analyse to avoid any accident. What is meant by mixed traffic? This may be 4-wheeler bus, cars, 3-wheeler autos or 2-wheeler scooters. Therefore, full attention is required in smooth running of the traffic. In this, the important factor is driver's role. The driver's skills, experience, attention, presence of mind are the major factors.

II. DRIVER DECISION MODEL

Now we propose a driver decision model. It will not generate continues time traffic properties such as speed, lane or longitudinal distance of the vehicle. Thus, it is necessary to produce such traffic properties by adopting adequate substitute for driver's manipulation and the vehicle.

For the above two proportional derivative (PD) controllers calculates human drivers inputs such as manipulation of steering wheel and an accelerator and the vehicle dynamic model translates the human drivers inputs to physical vehicles data like velocity, position and the condition of the vehicle.

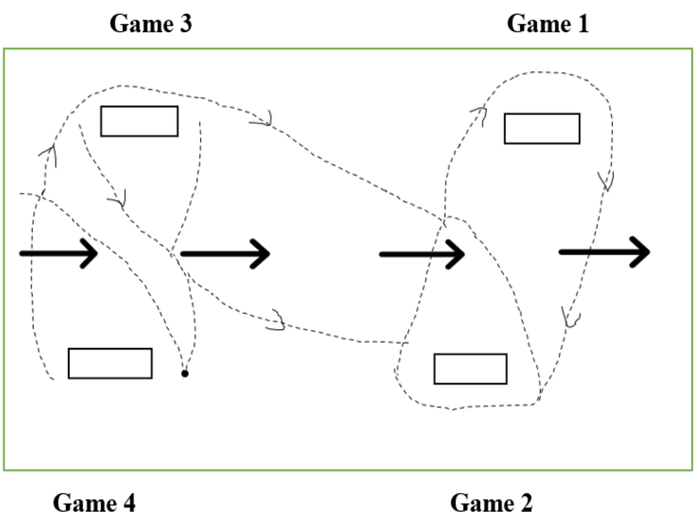

Fig. 1 Multiple Games on Two Lane Road

1. Vicinity Recognition:

In this study, it is important to know about system configuration.

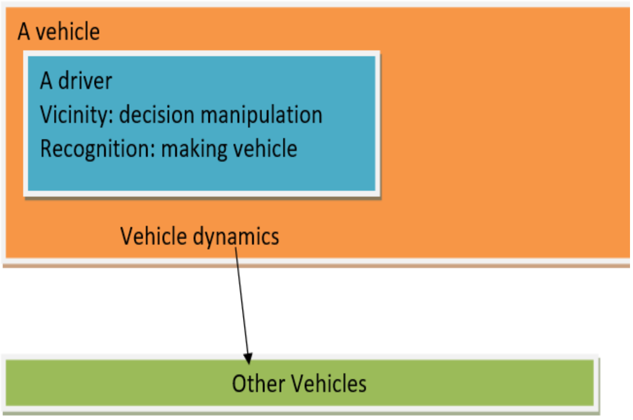

Fig. 2 System Configuration

From the Fig. 2, the following conclusions could be arrived. This function classifies the given vehicles surroundings into vehicles ahead, the leading vehicles and the vehicles behind, the following vehicles, according to their longitudinal position in each lane. Then the nearer vehicles in each lane are chosen as the vicinity vehicles. In reality, the vicinity recognition degenerates due to the internal and on external conditions. In this paper, we focus on the degradation of the information of the vicinity vehicles due to the internal factor, rather than the external conditions such as bad weathering. We add artificial errors to approximate the human uncertainty in recognizing their surroundings according to the driver's disposition.

III. DRIVER DECISION MODEL

Game theory has been widely used to represent a reasonable model of decision making since its inception. In particular STACKELBERG game theory is permitted to derive decisions among multiple players when game has sequential structure of decision among players. This supports the hierarchical structure in the driver's decision-making processes in highway.

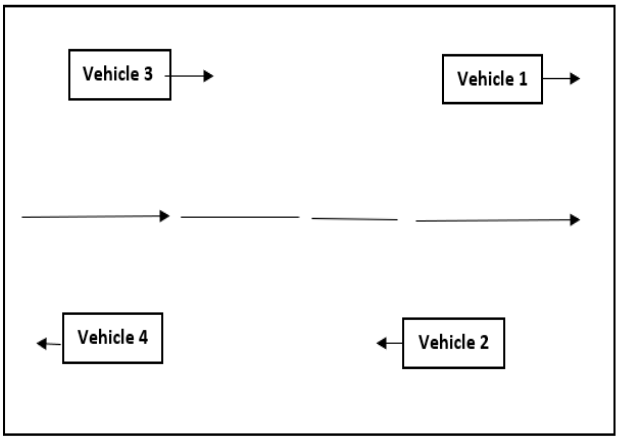

Fig. 3 Scheme for Ordered Vehicles

EXAMPLE:

Number of vehicles = 4
Vehicle 1 = Vehicle 2
Vehicle 3 = Vehicle 4

Look at the Fig. 3

i) Vehicle 1 has an information priority to vehicle 2, vehicle 3 and so on.
ii) In section 2, 1 has considered the application of STACKELBERG game theory to individual driver's decision modelling in highway settings.
iii) The gem theories decision is made by every driver respectively, in consideration of the followers responsive actions.
iv) The followers actions are assumed to base on the information from the vehicles that have higher priorities than itself, where the follower means the vehicle that has a lower priority.

Thus we have the same number of games as the number of drivers. For instance we have 4 different games for 4 players as in the Fig.3.

IV. SIMULATIONS [UNIT TEST SCENARIOS]

In respect of driver model for the merging situation, the following conditions are to be verified.

i) If the merging in vehicle can merge successfully with the designed driver merging model.

ii) If acceleration or deceleration produces beneficial results.

iii) How different the action of the vehicle is according to the driver aggressiveness.

For these purposes, let us consider two different scenarios where there are, a vehicle in the merging lane and five vehicles in the main line.

The merging vehicle as the proposed decision maker and the other five vehicles in the main line move with constant speed and without changing lanes.

Thus, each scenario is prepared to provide the merging in vehicle with the environment, where the merger is possible when the merging in vehicle accelerates or decelerates respectively.

We impose three different aggressiveness settings.

- Timed
- Normal
- Aggressive

On the merging in vehicle in each scenario we suppose that merging in vehicle accelerates to a certain speed such that merging to the highway is possible.

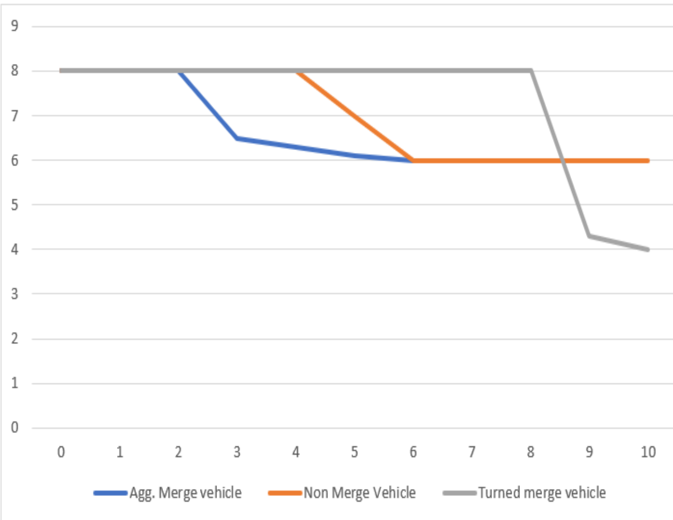

Fig. 4

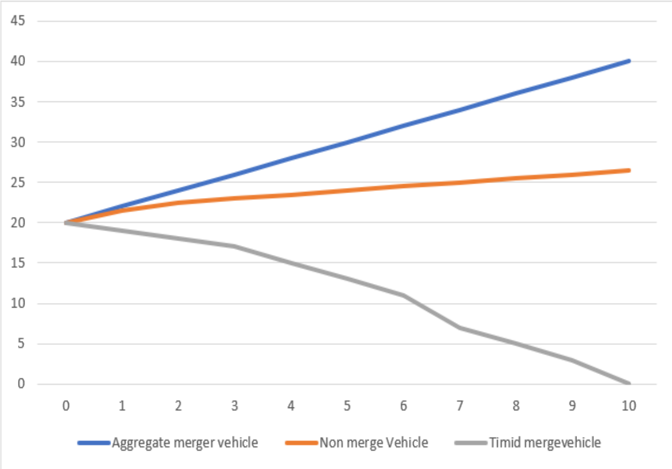

Fig. 5

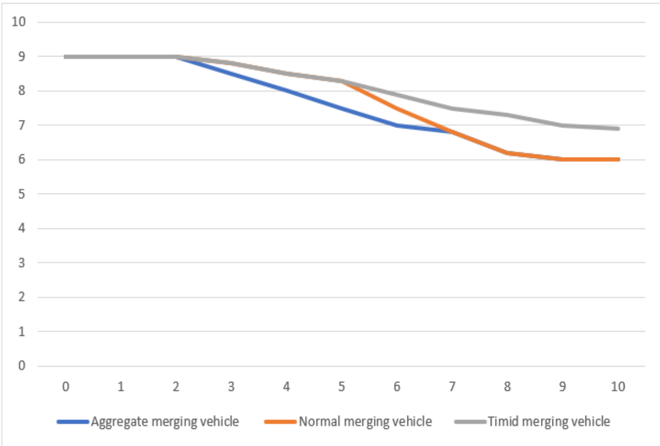

Fig. 6

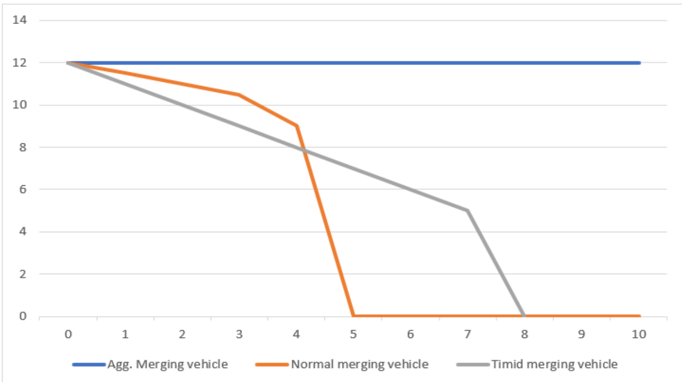

Fig. 7

The merge entrance starts from 50m in longitudinal direction and the length of the entrance is 100m. Lane 1, 2, 3 and merge lane are set to 0, 3.3, 6.6 and 9.9 m in lateral direction as shown in the Table-1.

TABLE I
Test scenario -1

	Initial condition		
	X_0(m)	Y_0(m)	V_0(km/h)
Vehicle 1 in the main time	0	10	80
Vehicle 2 in the main time	3.3	10	80
Vehicle 3 in the main time	6.6	10	80
Vehicle 4 in the main time	6.6	5	80
Vehicle 5 in the main time	6.6	-10	80
Merging vehicle	9.9	0	70

TABLE II
Test scenario -2

	Initial Condition		
	X_0(m)	Y_0(m)	V_0(km/h)
Vehicle 1 in the main time	0	10	80
Vehicle 2 in the main time	3.3	10	80
Vehicle 3 in the main time	6.6	10	80
Vehicle 4 in the main time	6.6	5	80
Vehicle 5 in the main time	6.6	-10	80
Merging vehicle	9.9	0	70

V. UNIT TEST RESULTS

For the above two scenarios, the simulation results are shown in the figures. They are indicating two respective decisions.

a) Merging instant
b) Acceleration

This indicates the driver's aggressiveness. They bottom figures shown the relative longitudinal of the vehicles with respect to the most rear main line vehicle.

CONCLUSIONS:

With the help of the study, it could be extended further in the following lines:

- The same study could be extended for 3 lanes and 4 lanes.
- Observations are to be recorded for the following timings.
  - Holidays
  - Working days
  - Peak hours
  - Learn hours
- Where even needed, the intelligence operation with latest instruments also may be experimented.

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