1 A brief description of the algorithm

1.1 basic assumption and parameters

The platform considers the maximum acceleration of the vehicle is a_{max}, which is generally used in the acceleration process and tbe braking process. Also, the maximum speed limit is set to v_{max}, while the minimum speed limit is set to v_{min}.

No matter which strategy is chosen, if the acceleration given by the strategy is greater than the maximum acceleration a_{max}, or the calculated speed is greater than the maximum speed or less than the minimum speed, the program will automatically set these values to the boundary value. When the vehicle has to stop because of the red light, the minimum speed of the vehicle is set to 0, describing the parking behavior which may exist, however, the behavior of reversing is never allowed.

Also, we assume the expected speed of the vehicle is set to 80% of the maximum speed limit.

In order to simpliy the simulation process, we assume that during the process of driving, there is no lane changing behavior. This hypothesis is also acceptable in the real life, because of the restrictions imposed by driving habits and traffic laws & regulations, the vehicle should finish changing lane before enter the traffic junction. Therefore this assumption is reasonable. What's more, just from the perspective of traffic efficiency, lane-changing can only reduce the average efficiency of the traffic, therefore, as the primary inspection of the platform is efficiency, lane-changing situation is not taken into consideration.

1.2 The Generation of the vehicles

It is assumed that the arrival process of the vehicle is approximately a Poisson process, which is limited and adjusted by the following algorithm

Assuming that the intensity of the Poisson process isλ, the arrival time interval of the vehicle S_n, S_{n-1}can be expressed as

$$P((S_n - S_{n-1} \leq t) = 1 - e^{-\lambda t}$$

Because the simulation time scale is set to 0.1s, the average hourly traffic flow is

$$\bar{F} = 36000\lambda$$

For the traffic flow in one direction, after the average hourly traffic flow is set by the traffic flow adjustment slider described above, The vehicles in this direction will be generated according to the Poisson process with a specified intensity of $\lambda = \dfrac{\bar{F}}{3600}$, and will be pushed into the pending queue $Q_{pending}$in each direction.

After generating the vehicle, the next step is to consider which lane the vehicle belongs to, and it is assumed that the possibility of the vehicle appearing in each safe lane is same. Firstly, the condition to determine a safe lane is that the distance of last vehicle in the lane and line which the vehicles are generated (S_{start}) is greater than the safe distanceS_{safe}, that is,

$$X_{-1} - S_{start} \leq S_{safe}$$

Screening all lanes that meet the situation above in this direction, and place the vehicle in $Q_{pending}$ into one of these lanes randomly, while the position of the vehicle newly generated is set to S_{start}.

If there is no lanes suitable for placing the vehicle currently, the vehicles will remain in $Q_{pending}$ and wait for the next simulation session.

The generation of the vehicle is done in the second step of the simulation cycle, just following the process control model.

1.3 The formation and evacuation of the queue in the intersection