IIEST, Shibpur
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Erstwhile B E College (Estd 1856)

VEHICLE TRACKING USING IOV

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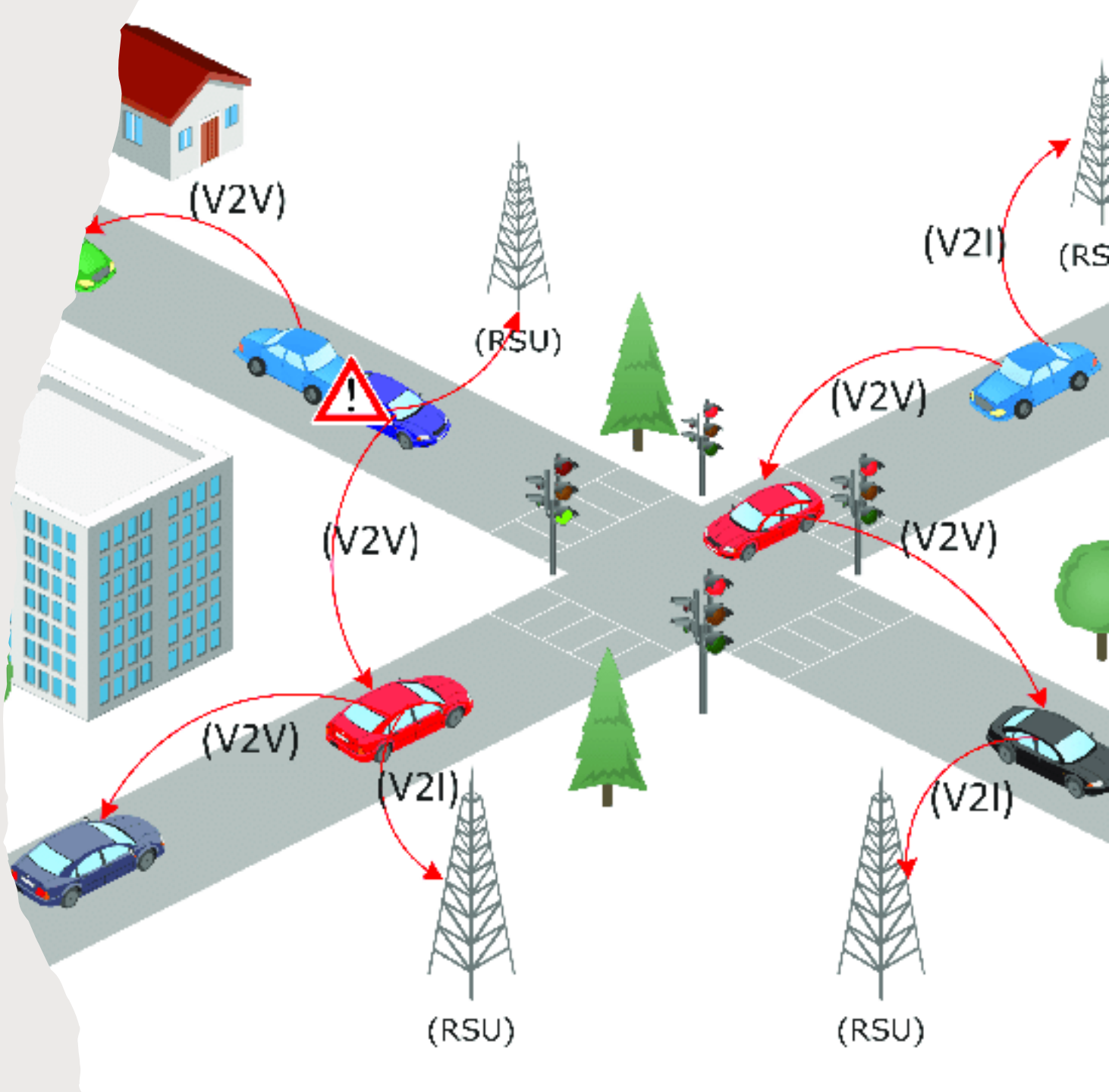
INTRODUCTION

- Vehicle tracking using Internet of Vehicle – network of vehicles and roadside units
- On the fly network formed, called ad-hoc network
- This ad-hoc network of vehicles is called VANET

WHAT IS VANET?

- Wireless multi-hop network
- Has a constraint of fast topology changes due to the high node mobility.
- Enables a wide range of applications, such as congestion detection, prevention of collisions, safety, blind crossing, dynamic route scheduling, real-time traffic condition monitoring, etc.



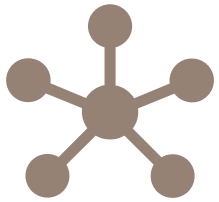
THE PROBLEM

Need of a system which tracks traffic and detects congestion in road

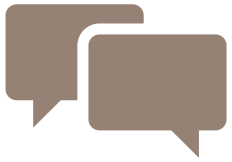
Current centralized solution has many drawbacks

Build an efficient system for this task

SOLUTION



Distributed system



V2V communication

Traffic congestion detection

IMPLEMENTATION

Congestion Detection Algorithm with Adaptive Broadcasting

STEPS


Speed Monitoring
Congestion Detection
Localization
Aggregation
Broadcasting

SPEED MONITORING

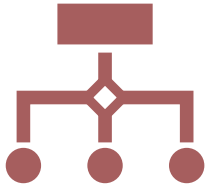
- Use speed as an indicator of congestion
- Concept of threshold speed

CONGESTION DETECTION

- Calculation of Congestion Parameter, $C_p = \eta * \pi$
- $\pi = 0$ if $V_c > V_t$ or 1 if $V_c < V_t$
- $\eta = \{1, 2, 3, 4, 5\}$ depending on time interval
- Congestion parameter value from vehicle's database is C_d

LOCALIZATION

Each street section has unique identification parameter A_{id}



This process retrieves the identification of the node's current location and sets A_{id} parameter to this value

Included in BSM message with C_p and is used to store received data in vehicle's database

AGGREGATION

- Responsible for the adaptation of broadcast intervals
- In case $V_c < V_t$: broadcast only if $C_p > C_d$
- In case $V_c > V_t$: broadcast only if $C_p \neq C_d$

BROADCASTING

- Broadcast the message containing C_p and A_{id} parameters
- All nodes who receive this message will know about traffic situation in A_{id} area
- Following the previous steps, they can broadcast when necessary instead of doing it periodically

OVERALL ALGORITHM AT A GLANCE

A) Speed Monitoring:
if $V_c \neq V_t$ go to B.

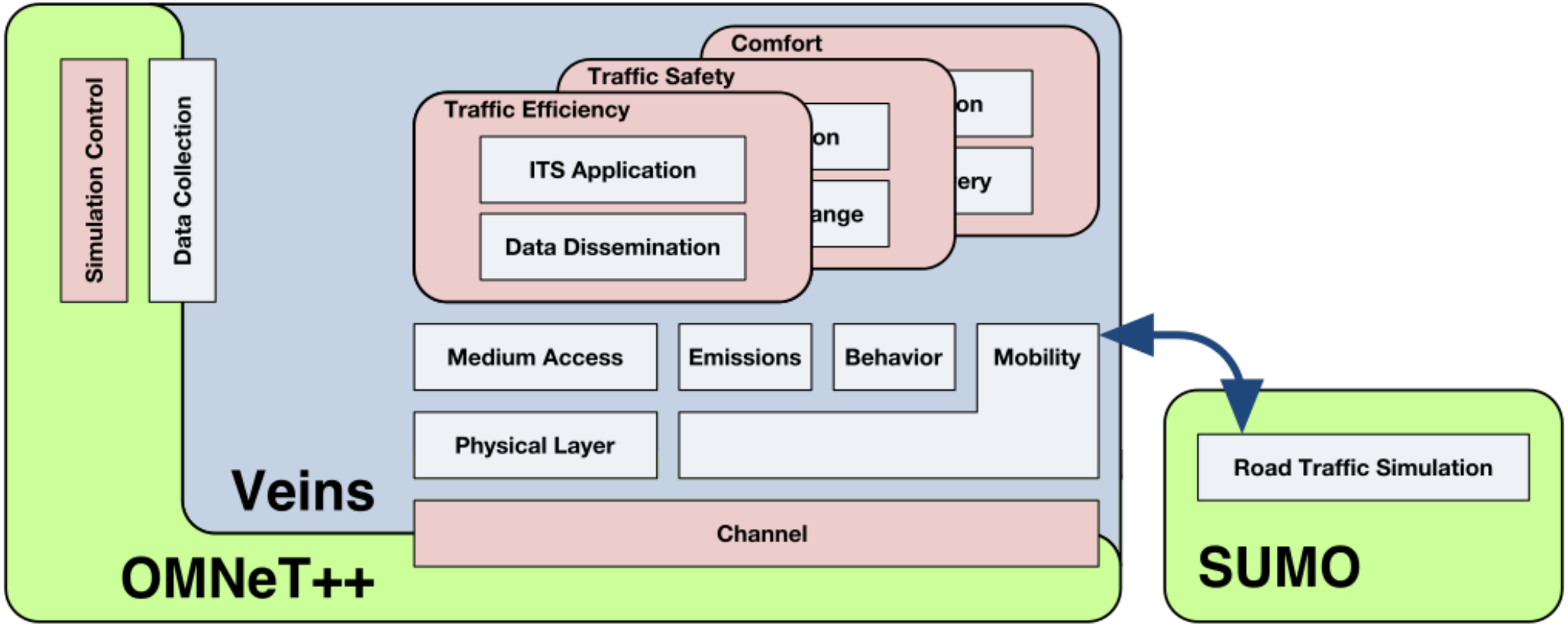
B) Congestion Detection:
if $V_c < V_t$ then
(start timer τ_c, when $\tau_c = \eta \cdot 10s \Rightarrow C_p = \eta$)
else (start timer τ_c, when $\tau_c = 10s \Rightarrow C_p = 0$)

C) Localization:
find A_{id} of the current location, go to D

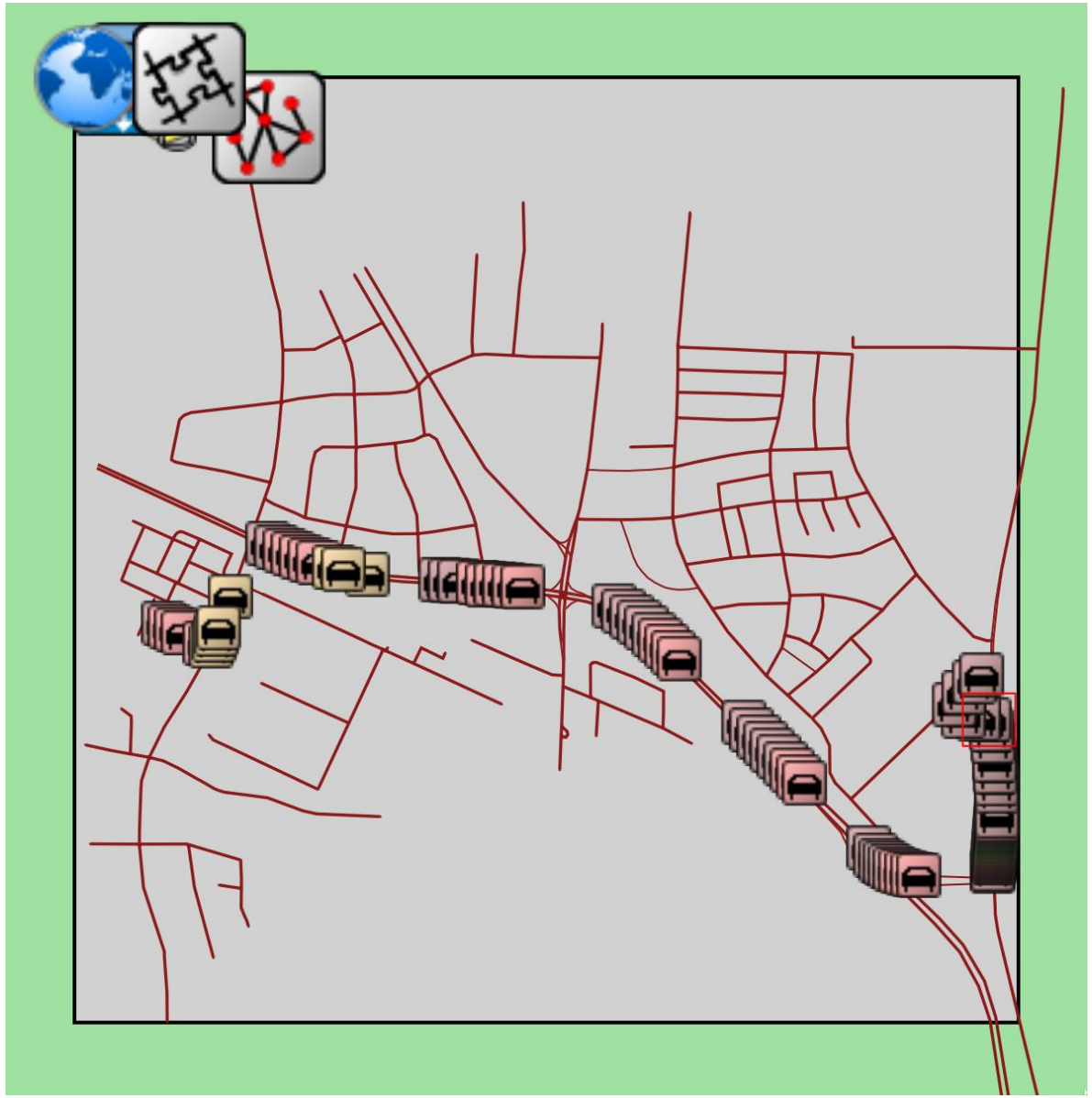
D) Aggregation:
get $C_d(A_{id})$
if $C_p \neq 0$ then
if $C_p(A_{id}) > Cd(A_{id})$ then E, $C_d(A_{id}) = C_p(A_{id})$
else skip E
else if $C_p(A_{id}) \neq C_d(A_{id})$ then E, $C_d(A_{id}) = Cp(A_{id})$ then E
else skip E

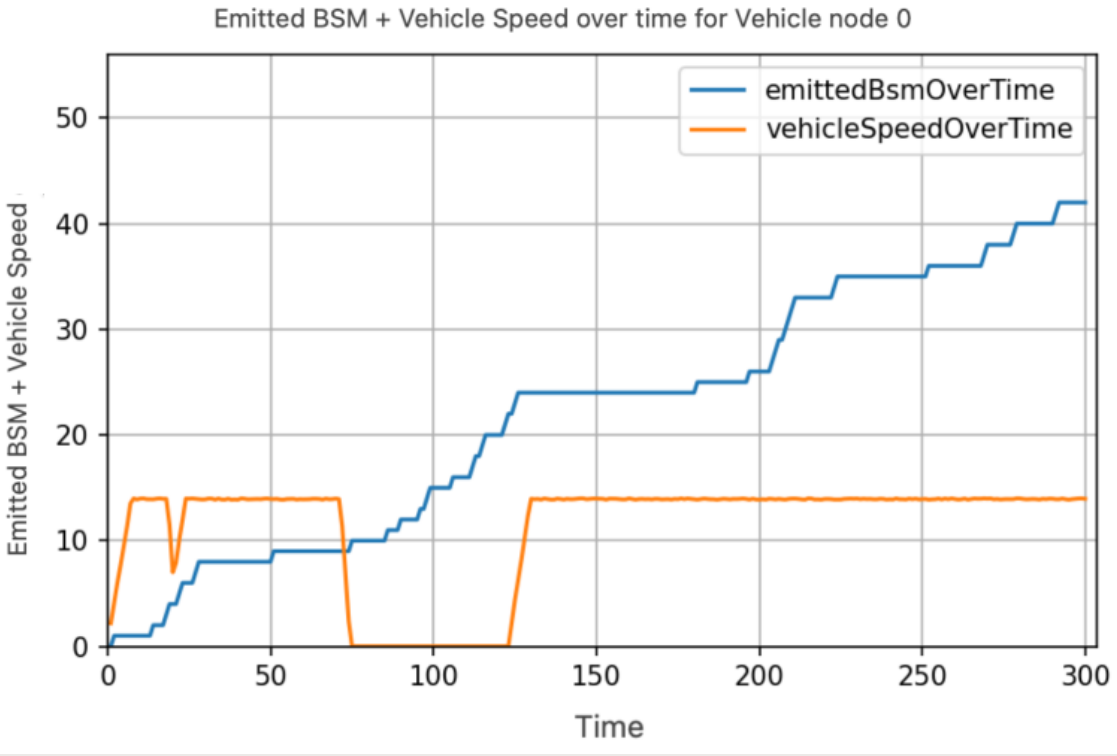
E) Broadcasting:
broadcast the (C_p, A_{id})

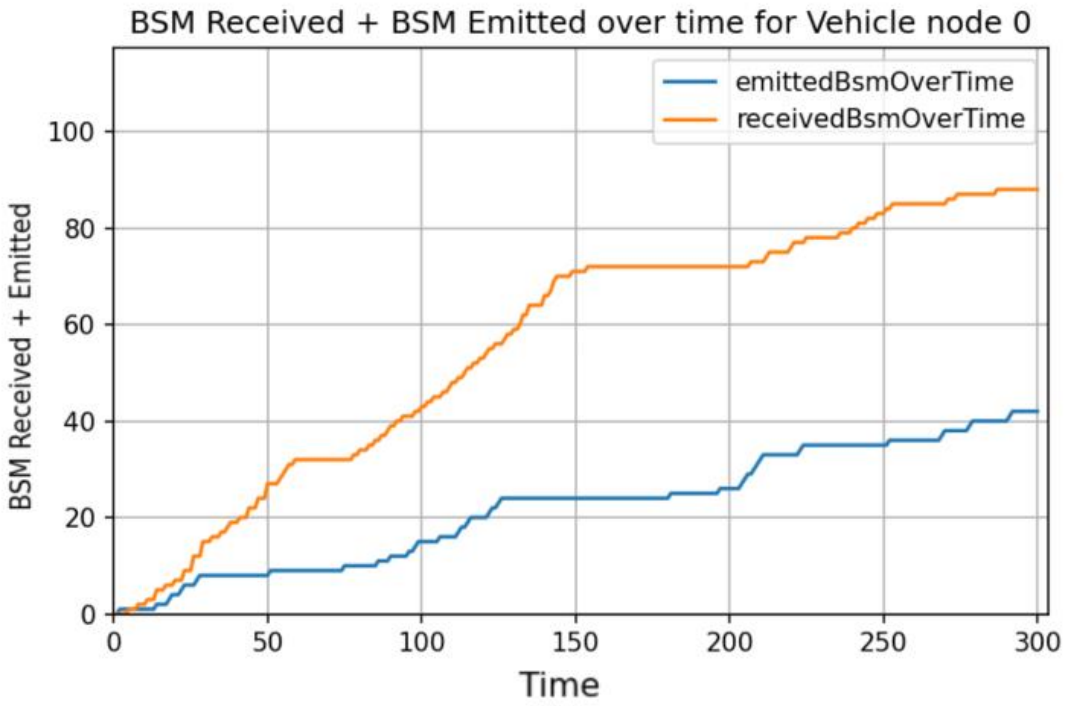
SIMULATION SETUP



SNAPSHOT OF A CONGESTED STREET




Emitted BSM + Vehicle Speed over time for Vehicle node 0
emittedBsmOverTime
vehicleSpeedOverTime
Emitted BSM + Vehicle Speed
Time
0
10
20
30
40
50
0
50
100
150
200
250
300


BSM Received + BSM Emitted over time for Vehicle node 0
emittedBsmOverTime
receivedBsmOverTime
BSM Received + Emitted
Time
0
20
40
60
80
100
0
50
100
150
200
250
300

METRICS

DRAWBACKS OF CURRENT IMPLEMENTATION

Directional flow of traffic not considered

Possibility to optimize the number of emitted beacons

FUTURE SCOPE

01

Taking the directionality of traffic into account

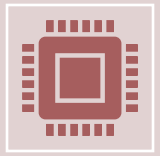
02

Checking if the use of RSUs can reduce the load on the network traffic, shifting towards a hybrid (centralized + distributed) architecture

CONCLUSION

Investigated the effectiveness of VANET in capturing vehicle congestion.

Results showed the ability of the system to relay congestion data to all vehicles.



Simulation revealed that the VANET system was able to adapt to changing traffic conditions and maintain high performance.

THANK YOU