Energy-Aware Zero-Touch Management

I. Experiment 1

This is my starting point [1,2]

Every physical capability of the Roadside Unit (RSU) is different from each other in terms of maximum wattage. When the RSUs were stressed based on the amount of vehicles, they have a limit of watts also linked to the CPU consumption.

TABLE I
AVERAGE VEHICULAR COUNTS AND POWER CONSUMPTION PER RSU.

RSU	Night (17:00–06:00)		Day (06:00–17:00)	
	Vehicles	Power (W)	Vehicles	Power (W)
1	0	59	4	58
2	1	55	7	55
3	5	56	23	56
5	2	51	7	51
6	1	60	5	60
7	6	61	16	61

Table III summarizes the maximum number of users (U) and the corresponding maximum wattage (W) capacity for each RSU. As shown, RSU 5 supports the highest number of vehicles and reaches a higher power consumption compared to the others. This variation highlights the heterogeneous nature of the RSUs in the testbed. Figure 1 visually presents the relationship between the number of vehicles and the power consumption for each RSU, illustrating how the power usage increases with the load and reaches a plateau at the maximum capacity.

Max vehicles registered: 39 RSU 5

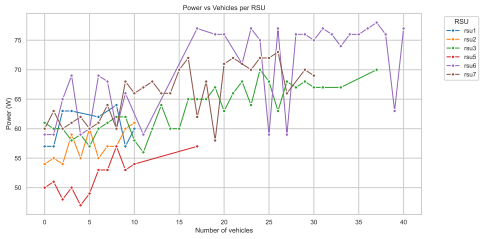

Fig. 1. Caption describing the figure.

TABLE II
LOCATION MAPPING BETWEEN INDUCTIVE SENSORS AND RSUS TO MONITOR VEHICULAR TRAFFIC PER RSU IN THE E13 HIGHWAY, ANTWERP BELGIUM.

RSU	Vehicles	RSU Location	Nearest Inductive Sensor
1	12	51.210575, 4.46655	51.21056678, 4.466446158
3	25	51.215186667, 4.450568333	51.21587307, 4.452993707
7	12	51.210616667, 4.480896667	51.21066931, 4.480559376
8	26	51.211091667, 4.491425	51.21127494, 4.491424033
4	16	51.21574, 4.457151667	51.21577734, 4.457154961
6	16	51.211236667, 4.472586667	51.21121407, 4.472483657

TABLE III
MAXIMUM U AND W CAPACITY FOR EACH RSU.

RSU	Max U	Max W Capacity
1	27	69
2	27	67
3	27	70
5	36	68
6	27	77
7	31	75

References

[1] 3rd Generation Partnership Project (3GPP), "5G; Service Requirements for Enhanced V2X Scenarios," Technical Specification TS 22.186, ETSI, 2024. Online [Available]: https://www.etsi.org/deliver/etsi_ts/122100_122199/122186/18.00.01_60/ts_122186v180001p.pdf, Date accessed: 2025-02-12.

[2] 3rd Generation Partnership Project (3GPP), "5G; 5G Media Streaming (5GMS); Profiles, codecs and formats," Technical Specification 3GPP TS 26.511 V18.1.0, ETSI, 2024. Release 18.