

Deploying Cellular Vehicle-to-Everything Infrastructure on Highway I-275

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Intelligent road infrastructure consisting of sensors and communications is needed to deploy connected and automated vehicles (CAVs) on real highways. Such infrastructure can support the operation of CAVs (e.g., maneuver coordination and onboard energy management), and bridge the connectivity gap resulting from the currently low penetration of connected vehicles and the limited range of vehicle-to-vehicle communication. Moreover, it also allows us to build high-efficiency transportation systems, leading to societal benefits such as emission reduction, energy efficiency improvement, and productivity increase.

In this project, we deploy cellular vehicle-to-everything (CV2X) infrastructure along the highway I-275, which consists of roadside units (RSUs), a server managed by the University of Michigan, and communications between them. The RSUs collect traffic information from the downstream vehicles on highway and send it to the university server for real-time processing. The processed information will then be sent to the upstream RSUs and broadcast to vehicles nearby, which allows the upstream vehicles to predict the traffic ahead and plan their motions accordingly. This way, traffic prediction and control can be achieved. To realize this, we established new types of V2X communication messages: traffic history message (THM) and traffic prediction message (TPM). These customizable messages can be transmitted between V2X devices using the protocol WSMP and transmitted between RSUs and server via the IoT protocol MQTT. We conducted experiments on highway I-275 using the installed RSUs and the designed messages with real vehicles. We demonstrated the effectiveness of the infrastructure-supported traffic prediction tailored to the needs of automated vehicle.