

**CHENNAI – PONDICHERRY**

**Reliable Safety Message Dissemination in NLOS intersections using TV White Spectrum**

**Abstract:**

Reliable safety message dissemination is a fundamental primitive for constructing intersection safety systems. Normally, the dissemination is based on vehicular communications, of which the de-facto standard is Dedicated Short Range Communications (DSRC). However, due to high frequency operations, a DSRC signal is seriously attenuated when being propagated in Non Line-Of-Sight (NLOS) conditions. Previous schemes leveraged the use of centralized infrastructures or relay vehicles enabling a safety message to bypass large obstacles. However, implementing the infrastructures in all intersections would be very costly; one may not find proper relay vehicles in low density, and frequent rebroadcasts cause serious network congestion in high density. To address this challenge, we propose a novel scheme that exploits excellent propagation characteristics of a TV White Space (TVWS) band (in addition to a DSRC band) for reliable dissemination in NLOS intersections. To ensure reliable dissemination throughout a broad range of densities without infrastructures, our scheme employs two innovative mechanisms: a collaborative procedure and a Dynamic optimal Configuration (DoC). To our knowledge, this is the first that simultaneously satisfies two vital demands for intersection safety system: 1) lacking infrastructures and 2) working well in all densities. Simulation studies show that the proposed scheme outperforms previous infrastructure-based schemes.

**Existing System:**

The Dedicated Short-Range Communication (DSRC) is a de-facto standard for vehicular communications, which uses a 5.9 GHz licensed band (we call this frequency band a DSRC band. In a DSRC band, however, a signal cannot pass through large-size obstacles (e.g. buildings), thereby inducing severe signal distortion at receivers in Non Line-Of- Sight (NLOS) conditions. In urban intersections, buildings at a corner typically cause NLOS conditions between vehicles located at different sides of the corner. (e.g., more than 80% of intersection corners contain NLOS conditions in Munich [5]). Thus, a vehicle using direct DSRC communications usually fails in delivering beacon safety messages to the vehicles at the other side of corners. According to previous measurements in [5], Packet Error Rate (PER) is close to 100% when a sender and a receiver are 60m and 80m, respectively, away from the center of an intersection. Considering the large dissemination range requirements of most intersection safety services (i.e., over 250m from the center of an intersection [3]), it is difficult to construct intersection safety systems using direct DSRC communications.

The simple and widely used solution is to exploit a centralized Road Side Unit (RSU) to circumvent large obstacles at corners [8]. Despite its excellent performance, implementing RSUs in all intersections represents a significant investment of money and time1. In [9], the authors proposed using LTE and Wi-Fi bands, but the performance has proved unsatisfactory, despite its expense. Even worse, relying on centralized infrastructures (e.g., RSU, LTE Base Station) is prone to a single point of failure.

**Proposed System:**

Our paper proposes several novelties that set our work apart from previous works. First, to the best of our knowledge, this is the first attempt that simultaneously satisfies two important demands for reliable dissemination in NLOS intersections: 1) being independent of a radio communication infrastructure and 2) working well in all vehicle densities. Second, the proposed mathematical model is the first to describe delay distribution and BIRT in two dimensional environments (i.e., an intersection), while most previously proposed models considered one dimensional topology (i.e., a highway) for analytical tractability.