# Project Proposal for Ph.D.

## Enhanced Vulnerable Road Users Safety (VRU) in V2X communication

### Project Summary

**Vulnerable Road Users Safety (VRU)** - Along with communication in V2X technologies, the Intelligent Transportation System (ITS) is constantly developing and giving door to new applications and services. Protecting vulnerable road users (VRU), such as pedestrians, cyclists, motorbikes, animals, etc., has become increasingly important in light of the huge increase in traffic fatalities. There may be a number of measures to increase the road safety of such vulnerable road users. These include using onboard alerts to help drivers make decisions, activating reversing controls inside the car, and monitoring v2x networks, which is typically done in conjunction with other equipment using V2X protocols and network capabilities that can be further investigated with standard-driven research and deployment for India-focused scenarios.

**Possible solutions**- Future intelligent transportation systems (ITSs) are expected to include vehicle-to-everything (V2X) communication and services, which has attracted significant interest from various stakeholders. This is because they provide so many advantages. But many of these services have strict performance standards, especially with regard to latency and delay. By moving these services closer to vehicle, multi-access/mobile edge computing (MEC) has been suggested as a viable solution. MEC is a key component of the 5G ecosystem, ensuring URLLC (Ultra-Reliable Low Latency Communications) for V2X communication and also helping to deploy services in the appropriate locations. Edge computing also helpful to provide MBMS (multimedia broadcasting and multicasting services) in V2X environment.

**Standard in USE**- Different standard define by ETSI, IEEE etc. for edge computing v2x, WLAN.

**Research phases**-
1. Study of different standard of MEC and V2X and other
2. Develop a Basic client server prototype of VRU safety
3. Development of MEC V2X specific platform system with different capabilities
4. Start integration V2X MEC system with open source 5G network and prepare 5G based V2X test bed
5. Deployment of V2X- VRU use cases for performance measure
6. VR and micro-simulation-based assessment of the V2X-VRU use cases
7. prepare publications of patent for project

### Appendix

**In addition, VRU in V2X also focusing Improve quality of Traffic Monitoring Data**
The quality of data detected from the road or intersection must be satisfactory in all lighting and environmental situations. While the widely used low-cost camera sensors perform admirably for traffic monitoring, they fall short in challenging videography situations like sun glare, shadows, or even the foggy or smoggy weather conditions common in North India with its high levels of pollution. Here is where RF-based sensors, such as mm-wave sensors, will be helpful. Weather and other unfavorable conditions for the camera would not affect RF Radars. For greater performance, it is possible to investigate the New Radios with MIMO beam-forming capabilities for sensing at higher frequencies. Additionally, 5G technology will enable wireless communications with high capacity and low latency.

## Ph.D. Supervisors

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<thead>
<tr>
<th>Role</th>
<th>Name of Faculty</th>
<th>Academic Unit in IITD/Institute/University</th>
<th>Email ID (Official)</th>
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</thead>
<tbody>
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**Project requirements (Student qualifications, experience required, etc)**

*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)*

- B.E/B.TECH in electrical, electronic or computer science or equivalent with 7 CGPA and a valid GATE score card (GATE exempted for CFTI as per institute norms).
- OR
- ME/M.TECH in electrical, electronic or computer science or equivalent with 7 CGPA.

**Source of fellowship/funding**

( CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

IRD Project/ Own Fellowship

**Role of Faculty Members involved:**

| Supervisor-1 | Prof. Brejesh Lall  will supervise the selected student on AI/ML and 5G/6G standardization aspects |
| Supervisor-2 | Prof Sai Chand  will supervise the selected student on Transportation related aspect |