

5G mmWave V2X communications

Vehicular communications are seen as key enablers for smart vehicles and intelligent autonomous operation. Connected vehicles can use wireless communications to exchange the sensor data required for autonomous driving. They can support infotainment and safety applications and enable the vehicle to intelligently interact with its environment. As automation increases, vehicles must carry numerous sensors that generate high data rate streams. Current networks such as 802.11p and LTE do not support the gigabit-per-second data rates required for sensor data exchange between vehicles and infrastructure. Recently, millimeter wave (mmWave) techniques have been introduced as a means of achieving such high data rate streams.

5G mmWave communications will be explored for high data rate delivery and optimised for mobility. Multiple antennas and adaptive beamforming will be considered to increase throughput and coverage. The use of multiple antenna elements enables the use of beamforming to focus energy towards a specific vehicle. The channel conditions at these frequencies will be modelled since the use of higher frequencies faces challenges in increased attenuation losses and rapid channel variations.

However, GPS enabled vehicles have good location information and when coupled with velocity data the position of the vehicle can be accurately predicted over short time frames. Navigation route data, as well as GPS and velocity can be used for location prediction. Beam switching architectures can reduce the amount of repointing required by leveraging this position information. Multiple antenna elements also allow for spatial filtering and thus can substantially reduce interference and can also reduce Doppler spread.

In this project we will investigate high data rate 5G vehicular communications for different vehicle speeds and suitable beam selection and beam tracking algorithms. Both vehicle to vehicle and vehicle to infrastructure communications will be considered.

More Details and Contact:

For informal enquiries please email [Prof Andrew Nix](#) or [Prof Angela Doufexi](#).

How To Apply:

Please submit a PhD application using the University's online application system:

<http://www.bristol.ac.uk/study/postgraduate/apply/>. In the application form mention the project title above and list [Prof Andrew Nix](#) under "Proposed supervisor(1)" and [Prof Angela Doufexi](#) under "Proposed supervisor(2)".