**PhD Project Proposal**

School of Electronics, Electrical Engineering and Computer Science

& ECIT Global Research Institute

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| **Proposed Project Title: Learning-driven physical layer wireless technology for programmable universal connectivity** |
| **Principal Supervisor: Dr Youngwook Ko Second Supervisor:**  |
| **Project Description:** As intelligent and connected electric-vehicles become more sophisticated, the need for autonomous connected systems that can intelligently configure wireless transmissions at run-time with minimal or no human interventions increases, especially in unpredictable time-varying operating conditions. For a large-scale intelligence, a large number of machines/sensors in- and around connected-autonomous vehicles (CAV) and across a range of smart unmanned vehicle infrastructure will be deployed (e.g., at least 300 sensors per electric vehicle). Current CAV technology has attempted to improve the latency and reliability of wireless network in today and future vehicular communications (e.g., see Zigbee (IEEE 802.15.4), Bluetooth (IEEE 802.15.1), 5G-V2V), considering both cellular systems and non-cellular applications. However, existing predefined physical layer technology at the design stage suffer from lack of autonomous opportunities towards fully CAV scenarios. Hence, the stage of the art physical layer wireless connectivity in unpredictable time-varying environments is opaque and far behind the industrial requirements. The physical layer connectivity disruption caused in unpredictable wireless environments needs special attention. This PhD programme will open a new paradigm for communications in autonomous scenarios, extracting exploitable multi-dimensional physical layer features. For this, main objective of this project is to develop new machine learning techniques to be applied to both precoding and modulation/demodulation solutions for beyond 5G wireless systems. For example, a convergence between artificial intelligence and physical layer technology will make a connectivity to a variety of machines inside/outside electric vehicles, more resilient to extreme wireless environments. Irrespective of vehicular body structure and surrounding, this project aims to develop opportunity for automatically modulating/demodulating data in relation to vehicles, which should be programmable at run-time. Simultaneously, the devised solutions are to provide high reliability and resilience in unpredictable time-varying scenarios at reduced signalling burdens and energy consumption.  |
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