IFN712 Research Project Proposal-Form

(Submitted to [y.feng@qut.edu.au](mailto:y.feng@qut.edu.au) by 30 June 2025)

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| Project agency (school, industry) | School of Computer Science |
| Industry supervisor and contact emails | Wenzong Gao, wenzong.gao@kurloo.io |
| Academic Supervisor name(s) and contact emails | Yanming Feng, y.feng@qut.edu.au |
| Information Technology major(s) | Data Science and Computer Science |
| Project title | Testing and Validating the Impact of GNSS Signal Obstruction on Positioning Accuracy |
| Brief description of the research problem, gaps, aims, methodology and expected outputs (~200 words) | Global Navigation Satellite Systems (GNSS), such as GPS, are essential for accurate positioning in a wide range of applications. In real-world environments, GNSS receivers are often deployed in locations where satellite signals may be blocked or degraded by obstacles such as buildings, trees, or other structures. These obstructions can cause signal loss, multipath effects, and ultimately reduce the accuracy and precision of GNSS-based positioning.  This project aims to systematically evaluate how signal obstructions impact the precision of GNSS positioning. In our setup, multiple GNSS receivers have been installed in environments with varying degrees of obstruction. Some receivers experience clear sky visibility, while others are partially or heavily blocked by surrounding obstacles.  The proposed methodology involves identifying and removing GNSS satellite signals that are affected by these obstacles—typically those arriving from certain azimuth (direction) and elevation (angle above the horizon) ranges. By processing the GNSS data both with and without these obstructed signals, the project will quantify the resulting changes in positioning accuracy and precision. This approach allows for a controlled analysis of how different types and degrees of signal blockage impact positioning results.  Expected outcomes include a reproducible method for filtering obstructed signals, quantitative assessments of precision degradation due to obstacles, and practical recommendations for optimizing GNSS receiver placement and data quality in challenging environments. |
| Answerable research questions for 3-5 students | * How does simulated removal of GNSS signals from certain azimuth and elevation ranges impact positioning accuracy and precision? * How do the effects of signal obstruction vary across different datasets and environmental conditions? * What are the minimum sky visibility requirements for maintaining acceptable GNSS positioning accuracy in obstructed areas? * What strategies can be recommended for GNSS data quality control and receiver deployment in challenging environments? |
| 3-5 key references (very preferable for students to start) | * RTKLIB manual (http://www.rtklib.com/prog/manual\_2.4.2.pdf) * Langley, R. B. (1999). Dilution of precision. *GPS world*, *10*(5), 52-59. * Hussain, A., Akhtar, F., Khand, Z. H., Rajput, A., & Shaukat, Z. (2021). Complexity and limitations of GNSS signal reception in highly obstructed enviroments. *Engineering, Technology & Applied Science Research*, *11*(2), 6864-6868. * Springer Handbook of Global Navigation Satellite Systems. (2017). <https://doi.org/10.1007/978-3-319-42928-1> |
| Required major of studies, skills, knowledge, and speciality | Students majoring data science and computer science can participate in the project.  Programming skills (Python or Matlab) |
| **Industry-based project: Student IP Agreement.** This is the IP model agreed between the parties. Please note that it is QUT policy that where possible students should be allowed to keep their IP. If students are asked to assign their work then please **provide a brief rationale** as additional permissions are needed by QUT to approve. | Project IP vests in the Student with a license back to Industry Partner **(license)**  OR  Project IP vests in the Industry Partner with a licence back to the Student **(assignment)**  OR  Academic project |
| Number of students | 3-5 |
| Student names (if known) |  |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| Remarks on conditions of offer | The supervising team will shortlist the candidates after their application. |