

EEE4022S/F Topic template

Student proposed?	N	
ID:	JBM24-05	
SUPERVISOR:	Joyce Mwangama	
TITLE:	Creating a Simple Simulation Tool for Communication Between Road Vehicles and the Network	
DESCRIPTION:	<p>This project aims to develop a simulation tool to model and analyze communication between vehicles (Vehicle-to-Everything, V2X) and the network infrastructure. With the rise of connected and autonomous vehicles, reliable communication between vehicles and network elements (e.g., roadside units, cellular base stations) is critical for ensuring safety, traffic efficiency, and enhanced driving experiences. The simulation tool will facilitate the design, testing, and optimization of V2X communication protocols and strategies, allowing researchers to evaluate various scenarios and improve the robustness and performance of vehicular networks.</p>	
DELIVERABLES:	<ol style="list-style-type: none"> 1. Conduct a comprehensive literature review on existing V2X communication models and simulation tools. 2. Identify key requirements, challenges, and use cases for the simulation tool. 3. Design the architecture and functionalities of the simulation tool, including modules for different V2X communication scenarios (e.g., vehicle-to-vehicle, vehicle-to-infrastructure, vehicle-to-network). (Define the metrics and parameters for evaluating communication performance.) 4. Develop core modules for simulating vehicular communication, which may include models for vehicle mobility, signal propagation, or interference. 5. Integrate the core modules into a cohesive simulation tool with a user-friendly interface. 6. Develop visualization tools to display simulation results and performance metrics. 	
SKILLS/REQUIREMENTS:	Proficient programmer in Python, C, C++, or Matlab. Comfortable with network simulators, wireless protocols and wireless network measurements.	
GA 1: Problem solving: <i>Identify, formulate, analyse and solve complex* engineering problems creatively and innovatively</i>	<p>The project involves addressing several complex problems, including:</p> <ol style="list-style-type: none"> 1. Modeling the dynamic and highly variable nature of vehicular environments. 2. Developing accurate algorithms for simulating signal propagation, interference, or mobility patterns. 3. Ensuring the tool can accommodate different V2X communication standards and protocols. 	
GA 4**: Investigations, experiments and analysis: <i>Demonstrate competence to design and conduct investigations and experiments.</i>	<p>The project will involve:</p> <ol style="list-style-type: none"> 1. Researching current V2X communication protocols, mobility models, and integration strategies. 2. Implementing and testing various models and algorithms within the simulation tool, running different scenarios to validate their effectiveness. 3. Evaluating the simulation results to refine algorithms, improve accuracy, and validate the overall tool design. 	
GA 5: Use of engineering	The project will make use of various engineering tools, including:	

tools: <i>Demonstrate competence to create, select and apply and recognise limitations of appropriate techniques, resources and modern engineering and IT tools, including prediction and modelling, to complex engineering problems</i>	<ul style="list-style-type: none"> • Network Simulation Software: Tools like NS-3, SUMO (Simulation of Urban MObility), Gazebo, or OMNeT++ for developing and testing simulation models. • Programming Languages: Languages such as Python or C++ for implementing simulation algorithms and user interfaces. • Visualization Tools: Software such as MATLAB or custom-built visualization modules for displaying simulation results. • Version Control Systems: Git for managing code
EXTRA INFORMATION:	H. Hejazi and L. Bokor, "A Survey on Simulation Efforts of 4G/LTE-based Cellular and Hybrid V2X Communications," 2021 44th International Conference on Telecommunications and Signal Processing (TSP), Brno, Czech Republic, 2021.
BROAD Research Area:	Vehicular Networks
Project suitable for ME/ECE/EE/ALL?	ECE or EE

Ethics clearance questionnaire

		Yes	No
Q1	Does this project involve data collection		X
Q2	Does this project involve utilizing a third-party data set		X
Q3	Does this project utilize machine learning (ML) or artificial intelligence (AI)?		X
Q4	Does it exceed the minimum risk defined here: Link [Answer is No here if your project does not utilize ML and AI]		X
Q5	Does this project involve external parties, funders, etc		X

Answer the following questions if you answer "Yes" to any of the above questions.

If the answer is "Yes" to **Q1**, please answer the following questions:

		Yes	No
Q6	Are there humans or animals directly involved in the data collection process or contains any identification information	n/a	

If the answer is "Yes" to **Q2**, please answer the following questions:

		Yes	No
Q7	Are the third-party data used anonymous (data does not contain human or animal-related information?)	n/a	
Q8	Are the third-party data used from an open source?		
Q9	Are the third-party data used from a different research group?		
Q10	If the answer to Q9 is "Yes", do you have the approval to use third-party data sets? Attach the proof to PSQ application.		

If the answer is "Yes" to **Q5**, please answer the following questions:

		Yes	No
Q11	Have you signed an MOU between the parties [If Yes, attach the proof to PSQ application.]	n/a	
Q12	Will there be a chance for any conflict of interest between the parties? [If Yes, provide details of the issue and your plan to solve it]		