COMP ENG 5430: WIRELESS COMMUNICATIONS SEMESTER PROJECT: GNURADIO EXPLORATION OF VANETS

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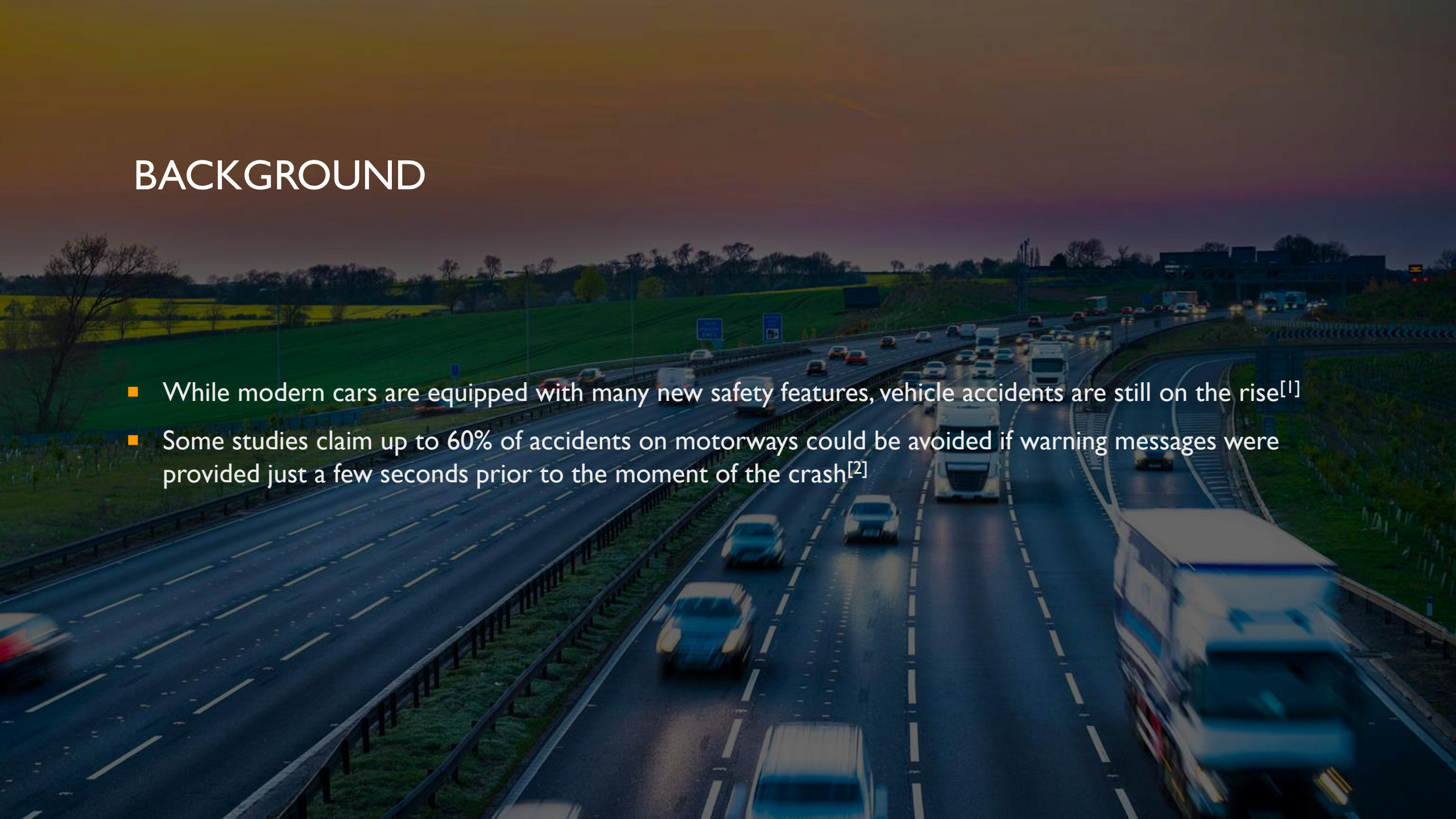
BACKGROUND



- While modern cars are equipped with many new safety features, vehicle accidents are still on the rise[1]
- Some studies claim up to 60% of accidents on motorways could be avoided if warning messages were provided just a few seconds prior to the moment of the crash[2]

VEHICULAR AD-HOC NETWORKS

- In recent years, significant interest has been directed toward the implementation of an ITS (Intelligent Transportation System) as a means of increasing road safety
  - Also provides opportunities to increase user convenience
- Toward that end, VANET (Vehicular Ad-Hoc network) topologies have received much attention as a potential solution
  - A subset of MANET (Mobile Ad-Hoc network) topology
  - Traditional networks such as TCP/IP are not suitable due to high overhead or slow initial connection
- A new communication standard was established to facilitate this development
  - Often called WAVE or 802.11p – operates at 5.85 to 5.925 GHz[5]
- Two main types of communication
  - V2V (Vehicle-to-Vehicle) – communication between any vehicles
  - V2I (Vehicle-to-Infrastructure) – communication between vehicles and RSU's (Road-side Units)

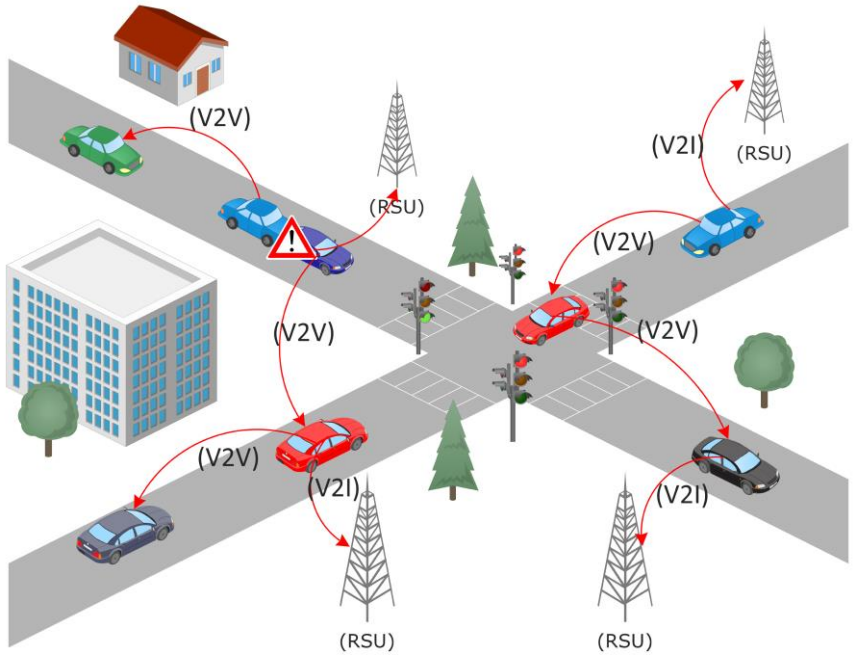


Figure 2 VANET Communication Architecture
Shah, Syed Sarmad, et al (2019) [4]

PREVIOUS RESEARCH AND GOALS

- Inspiration for the project was based on Bloessel, et al. [3]
- Demonstrated the ability of a simulated Transceiver in GNURadio to accurately simulate the performance of a hardware Transceiver
- The goal of the project is to use a similar structure to observe the performance of 802.11p vs. other standards such as 802.11e

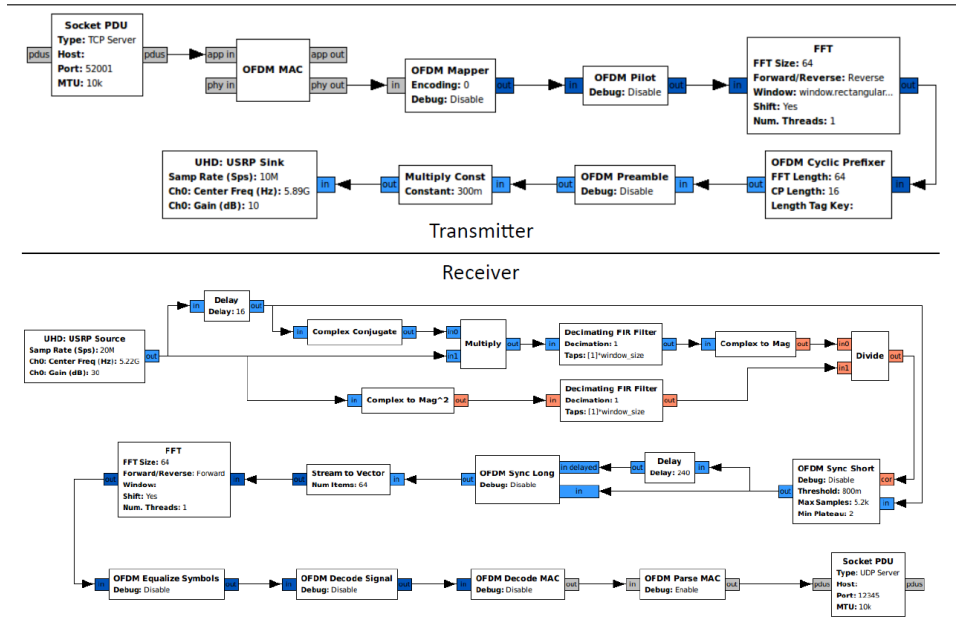


Figure 3: Overview of transceiver structure in GNURadio Companion
Bloessel, et al (2013) [3]

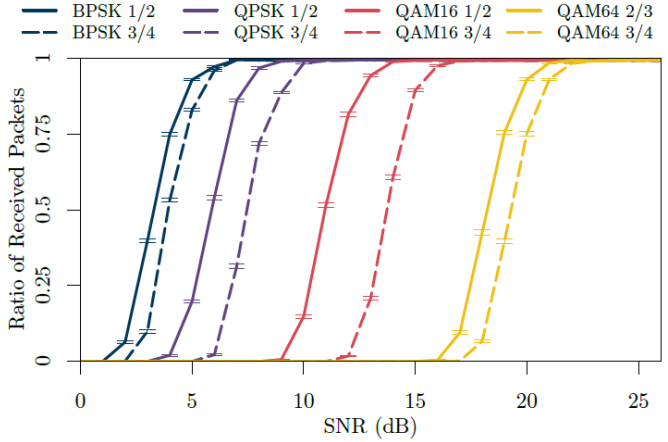
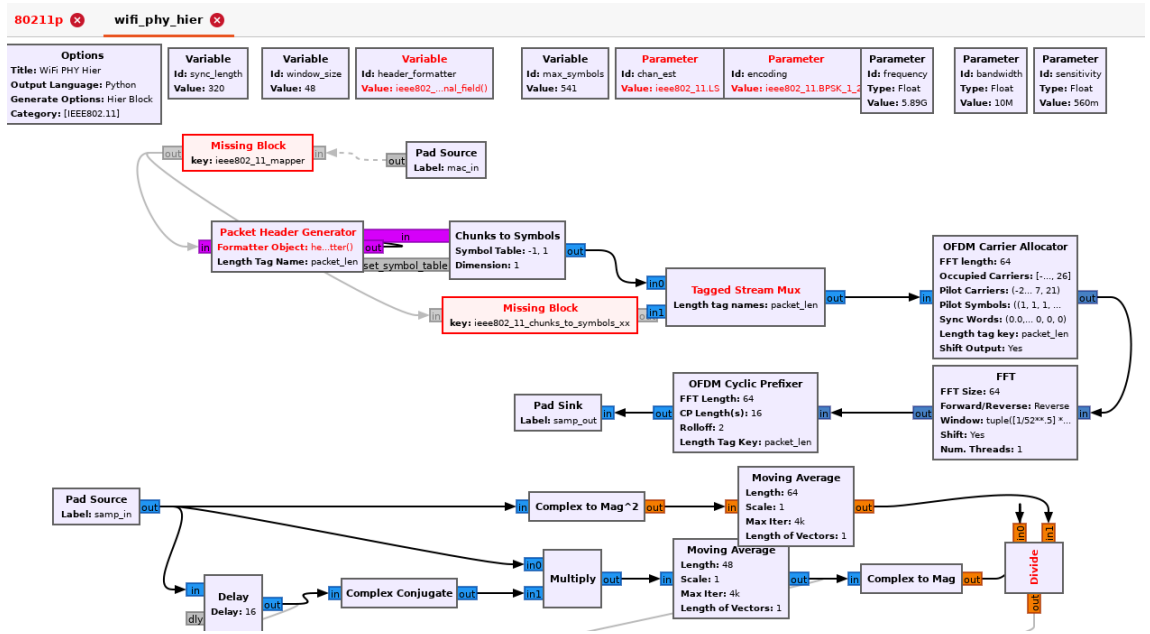


Figure 4: Simulated determined packet deliver ration of 133B sized packets over AWGN channel
Bloessel, et al (2013) [3]

IMPLEMENTATION PROGRESS



- Ran into issues with the installation of the 802.11 blocks
  - Required some manual modification of the source code to build successfully
  - Installation was successful but still some issues with missing blocks
- Plan is to finish the installation and do some benchmark testing with the simulated transceiver
- If the benchmark testing is successful, there may be an attempt to run it on hardware

REFERENCES

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2. B. Bloessl, M. Segata, C. Sommer, and F. Dressler, "Towards an Open Source IEEE 802.11p stack: A full SDR-based transceiver in GNU Radio," in *2013 IEEE Vehicular Networking Conference*, Boston, MA, USA, Dec. 2013, pp. 143–149. doi: 10.1109/VNC.2013.6737601.

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4. Shah, Syed Sarmad, Asad Malik, Anis Ur Rahman, Sohail Iqbal, and Samee Khan. "Time Barrier-Based Emergency Message Dissemination in Vehicular Ad-Hoc Networks." *IEEE Access* PP (January 31, 2019): 1–1. https://doi.org/10.1109/ACCESS.2019.2895114.

5. IEEE Standard for Wireless Access in Vehicular Environments (WAVE) – Multi-Channel Operation, IEEE Standard 1609, Mar. 2016, pp. 1-94.