📝 NLP Project – Technical Lead Report **Name:** Erin David Cullen **Date:** Week 11-12 (Monday 29 September - Sunday 12 October)

✅ 1. Work Completed (Since Last Report) *What you’ve built, implemented, tested or reviewed and an estimate as to how many hours it took to complete*

• Project video production and documentation (~4 hr)

• Webots simulation environment implementation (~8 hr)

• Python hub architecture development (~6 hr)

• **Feature/Module:** Drone Simulation Migration - Implemented drone simulation using Webots platform - Migrated project architecture away from ROS2 framework - Developed Python hub running with WebSocket communication - Integrated Webots simulation with Python hub backend - Connected live video feed from simulation to AI processing pipeline

• **Feature/Module:** Stereo Triangulation Depth Detection - Implemented stereo (nearest neighbour) triangulation system - Developed dual-camera pose beam projection algorithm - Created 2-point line calculation for beam intersection - Implemented minimum distance calculation for object centre determination - Integrated depth detection into existing AI pipeline

• **Feature/Module:** AI Pipeline Completion - Finalized integration of all AI processing components - Completed end-to-end automated detection and depth estimation - Validated full pipeline functionality in simulation environment

• **Tools/Libs Used:** - Webots simulation platform - Python WebSocket libraries - Computer vision libraries for stereo triangulation - Video streaming integration tools

• **Outcome/Results:** - Successfully migrated from ROS2 to Python-based architecture - Achieved functional drone simulation with live video processing - Completed stereo depth detection system implementation - Fully operational AI pipeline from video input to depth estimation - Project demonstration video completed

• **Contributions (if applicable):** - Led simulation platform migration and implementation - Designed and developed stereo triangulation depth system - Orchestrated AI pipeline integration and completion - Contributed to project documentation and video production

📌 2. Current Tasks in Progress *What you’re actively working on. Include blockers if any.*

| Task | Description | ETA | Blockers |
| --- | --- | --- | --- |
| None | The AI pipeline is complete |  |  |

📅 3. Upcoming Tasks *Planned work for the next sprint or phase.*

• **Task:** Performance Testing and Validation - **Purpose/Goal:** - Test AI pipeline performance across diverse scenarios - Validate depth detection accuracy metrics - Monitor system performance under various conditions - **Dependencies:** - Completed AI pipeline implementation - Webots simulation environment - Test scenario definitions

• **Task:** Final Documentation and Reporting - **Purpose/Goal:** - Document complete technical implementation - Record system architecture and design decisions - Prepare final project deliverables - **Dependencies:** - Completed testing and validation - Performance metrics collection - Project video completion

🚨 4. Issues & Risks *Bugs, technical debt, resourcing, or anything threatening progress.*

| Issue | Impact | Suggested Action | Owner |
| --- | --- | --- | --- |
| Simulation realism | Webots environment may not perfectly represent physical conditions | Document limitations in proof-of-concept scope | Team |

📈 5. Key Insights / Recommendations *Lessons learned, suggestions, architecture notes, or optimizations.*

• Webots provides more flexible simulation environment compared to Gazebo for this specific use case

• WebSocket-based architecture successfully resolved latency and bandwidth issues experienced with ROS2 framework

• Python hub design simplified integration and improved real-time communication performance

• Stereo triangulation using nearest neighbour approach provides effective depth estimation without complex sensor requirements

• Direct video stream integration enables real-time AI processing capabilities in simulation environment

• Completing AI pipeline milestone demonstrates project viability and technical implementation success

• Migration away from ROS2 reduced complexity, eliminated performance bottlenecks, and accelerated development progress