

Progress Evaluation 5

Remotely Controlled Car via LTE or Wi-Fi

- Christian Prieto, cprieto2023@my.fit.edu
- Joseph Digafe, jdigafe@my.fit.edu
- Nicholas Shenk, nshenk2023@my.fit.edu
- Donoven Nicolas, dnicolas2021@my.fit.edu

Faculty Advisor: Marius Silaghi, msilaghi@fit.edu

Client: Marius Silaghi, Computer Sciences & Cybersecurity, Florida Institute of Technology

Progress of Current Milestone (Progress Matrix)

Task	Comp %	Christian	Joseph	Nicholas	Donoven	To Do
1. Full System Integration (WebRTC, GPS, motor control, relay)	90%	45%	10%	45%	0%	Long-duration session testing, final stability hardening
2. Wi-Fi/LTE Failover — Pi Side (Pi routing complete)	50%	20%	0%	80%	0%	Implement server.js auto-switching logic
3. Autonomous Path Retracing (waypoint retrace navigation)	60%	50%	0%	50%	0%	GPS drift edge cases, dead-man integration, field testing
4. Connection-Loss Traceback (continued improvement)	70%	0%	0%	0%	100%	Further refinement of failure detection logic

Discussion of Accomplished Tasks

Task 1: Full System Integration (WebRTC, GPS, Motor Control, Relay)

Full system integration is substantially complete. WebRTC peer-to-peer communication is working end-to-end with motor control on the Raspberry Pi. Motor commands are issued through the WebRTC data channel from a single consolidated control file on the Pi. GPS is operational on the Pi and was validated through outdoor field testing. The relay server was updated to support the revised signaling flow, and a larger buffer size was added to the Pi to improve packet handling stability under variable network conditions. UI freeze issues during extended sessions were also identified and resolved as part of system stabilization.

Christian and Nick jointly led integration across all subsystems. Christian handled the relay server update, GPS field validation, and overall system architecture coordination. Nick led motor control binding and Pi-side WebRTC integration. Joseph performed control testing to verify end-to-end command delivery.

Task 2: Wi-Fi/LTE Failover — Pi Side

The Pi-side failover logic is complete. The vehicle can be reached directly over Wi-Fi at 192.168.4.20 or through the relay server over LTE, and Nick's Pi code accounts for both routing paths. The remaining step — implementing automatic switching logic in server.js so failover occurs without a session restart — is deferred to the next milestone. Session state maintenance across IP changes and control channel stability during transitions will be addressed as part of that server.js integration.

Nick led all Pi-side network handling and protocol work. Christian contributed to relay server coordination.

Task 3: Autonomous Path Retracing

Autonomous path retracing enables the vehicle to navigate back to its starting point by replaying GPS waypoints recorded during the outbound drive in reverse. A state machine manages waypoint progression with hysteresis to prevent oscillation near waypoints, and bearing computation drives steering correction. The feature is approximately 60% complete. Remaining work includes handling GPS drift edge cases, additional field testing, and integration with the dead-man safety system.

Christian and Nick jointly led the path retracing implementation and field validation.

Task 4: Connection-Loss Traceback Algorithm

Continued development on the connection-loss tracing algorithm, which tracks communication failures, logs disconnect events, and assists in diagnosing reconnect behavior across LTE and Wi-Fi transitions. Donovan continued iterating on the traceback logic this milestone, refining failure detection and improving diagnostic output to better surface the root cause of connection interruptions.

Contributions of Each Team Member

Christian Prieto

Co-led full system integration alongside Nick. Updated the relay server for revised signaling and session handling. Added a larger buffer size on the Pi for improved packet stability. Contributed to UI configuration and freeze fixes. Performed GPS field testing and outdoor validation. Co-led autonomous path retracing implementation. Served as draft planner for milestone documentation.

Joseph Digafe

Performed control testing to verify correct end-to-end command delivery through the WebRTC pipeline. Assisted with UI verification and system-level testing.

Nicholas Shenk

Led Pi-side network handling for Wi-Fi/LTE failover. Pi code accounts for both Wi-Fi direct (192.168.4.20) and relay-based LTE routing. Co-led WebRTC and motor control integration, GPS integration, and autonomous path retracing with Christian. Led motor control codebase organization and field validation.

Donoven Nicolas

Continued development and improvement of the connection-loss traceback algorithm. Refined failure detection logic and improved diagnostic output for debugging reconnect behavior. Assisted with hardware validation and integrated testing.

Plan for Next Milestone (Task Matrix)

Task	Christian	Joseph	Nicholas	Donoven
1. Complete Wi-Fi/LTE Failover (server.js auto-switching)	Relay coordination & session state	UI failover status indicators	server.js integration & protocol validation	Failover stress testing
2. Adaptive Video Bitrate (fix packet loss display first)	Testing & metrics	Packet loss UI fix & bitrate display	Bitrate encoding logic	Performance testing
3. Senior Design Poster (final draft for Showcase)	Overall layout & technical writeups	UI/video section	Subsystem diagrams & content	Traceback section
4. Bug Fixes & Finishing Touches (UI, control, stability)	Relay & system hardening	UI polish & packet loss fix	Motor/control edge cases	Traceback polish
5. Formal Evaluation & Testing (pending advisor latency guidance)	Latency metrics & data collection	Survey design & usability testing	Safety validation	Data collection
6. Final System Polish & Presentation Prep	Documentation & demo prep	UI final polish	Long-duration stability testing	End-to-end validation

Discussion of Planned Tasks

Task 1: Complete Wi-Fi/LTE Failover (server.js Auto-Switching)

Implement the remaining server.js logic to enable automatic network switching without requiring a session restart. This includes maintaining session state across IP changes and ensuring control channel stability during transitions between LTE and Wi-Fi.

Task 2: Adaptive Video Bitrate

The packet loss display on the car UI must be fixed first to expose the necessary data. Once unblocked, dynamic bitrate adjustment will be introduced based on real-time network conditions including packet loss, jitter, and RTT to improve video stability under LTE variability.

Task 3: Senior Design Poster (Final Draft)

Produce the final draft of the senior design poster for submission to the Showcase before the Milestone 6 due date. Content will cover system architecture, LTE/Wi-Fi communication design, WebRTC video streaming, motor control integration, GPS capabilities, and safety features. All team members will contribute their respective subsystem sections.

Task 4: Bug Fixes & Finishing Touches

Address remaining UI, control, and stability issues identified during testing. General system hardening and polish across all subsystems to ensure reliable long-duration operation.

Task 5: Formal Evaluation & Testing

Consult Dr. Silaghi on the correct latency measurement methodology — previous approaches have produced results that are significantly off. Once the method is confirmed, begin structured measurement of latency, reliability, and safety metrics. Collect operator usability feedback and document performance results based on the evaluation criteria defined in the presentation.

Task 6: Final System Polish & Presentation Prep

Conduct long-duration session testing to validate stability. Finalize all documentation and prepare the system demo for the senior design presentation and Showcase.

Meetings & Feedback

Client Meetings

Date(s) of meeting(s) with Client during the current milestone: _____

Client feedback on the current milestone: See Faculty Advisor feedback below.

Faculty Advisor Meetings

Date(s) of meeting(s) with Faculty Advisor during the current milestone: _____

Faculty Advisor feedback on each task for the current milestone:

Task 1: tcpdump/jc

Task 2:

Task 3:

Task 4:

Faculty Advisor Signature: Marius Silaghi Date: 03/20/26

Evaluation by Faculty Advisor

Faculty Advisor: detach and return this page to Dr. Chan (HC 209) or email the scores to pkc@cs.fit.edu

Score (0-10) for each member: circle a score (or circle two adjacent scores for .25 or write down a real number between 0 and 10)

Member	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Nick Shenk																
Christian Prieto																
Joseph Digafe																
Donoven Nicolas																

Faculty Advisor Signature: _____ Date: _____