

Target: Conference Paper Submission (January End)

Phase	Duratio n	Wee k	Focus Area	Key Tasks & Goals	Essential Paper Title / Reference
Phase 1: Foundations & Gap	4 Weeks	Week 1	SDN-VANET Architecture	Understand core SDVN concepts (RSU, OBU, Control/Data Planes). Deliverable: Architecture Diagram.	Yaqoob et al., 2022: "Software-Defined Vehicular Networks: A Survey..."
		Week 2	SDN-VANET Security	Summarize unique threats (Sybil, spoofing) and SDN vulnerabilities (Controller DDoS). Deliverable: 1-page Security Note & Draft Intro.	Ali et al., 2023: "Security Challenges and Solutions in SDN-Enabled VANETs..."
		Week 3	IDS Landscape in VANET	Systematically survey existing IDS methods (ML/DL) in SDVNs. Deliverable: Comparison Table (Method, Dataset, Metrics, Gaps).	Qureshi et al., 2024: "Intrusion Detection Systems for SDN-based VANETs: A Review..."
		Week 4	Final Gap Definition	Analyze how current models fail to capture temporal/mobility dynamics. Choose primary dataset (VeReMi or CICIDS/SUMO). Deliverable: Final	Alharbi et al., 2023: "Machine Learning-Based Security Solutions for

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				Research Gap Statement (Core Thesis).	SDN-VANETs..."
Phase 2: Design & Baselines	4 Weeks	Week 5	Data Preprocessing I	Download, clean, and normalize the chosen dataset. Start feature engineering (converting flows/packets into sequential data). Deliverable: Working Data Preprocessing Script.	VeReMi: "VeReMi Dataset: A Synthetic and Real-World Dataset..." (or relevant dataset paper)
		Week 6	Data Preprocessing II	Determine optimal sequence length (l) for the RNN input. Finalize feature set and train/test splits. Deliverable: Defined Model Inputs and Sequence Generation Logic.	Saini et al., 2024: "Optimizing Sequence Length for Time-Series Analysis..."
		Week 7	Baseline Implementation	Implement and train baseline models: Random Forest (ML) and a simple CNN/DNN (non-sequential DL). Record initial Accuracy, F1-Score, and Latency. Deliverable: Baseline Results Table.	Kumar et al., 2023: "Comparative Analysis of Random Forest and CNN Baselines..."
		Week 8	Core RNN Implementation	Implement the core LSTM or GRU model. Train, tune hyperparameters, and	Huang et al., 2023: "Deep Learning Approaches

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Phase 3: Novelty & Results	4 Weeks	Week 9	RNN Tuning & Latency	compare results against baselines. Deliverable: Working Core RNN Model Code and updated Results Table.	for Intrusion Detection in SDN-VANETs using Bi-LSTM"
				Fine-tune the RNN/GRU. Measure and optimize inference latency rigorously—essential for real-time vehicular systems. Deliverable: Optimized RNN Model and Latency Benchmark.	Khan et al., 2024: "Real-Time Optimization of Sequence-to-Sequence Models..."
				Implement and integrate the Attention Layer with your best RNN (GRU/LSTM). Train the final model. Deliverable: Working RNN+Attention Model Code.	Al-Qadasi et al., 2023: "Attention-Based Bidirectional LSTM for Advanced Traffic Flow..."
				Run comprehensive tests (Accuracy, F1, Recall, AUC, Latency) for ALL models (ML, CNN, RNN, RNN+Attention). Generate ROC Curve and Confusion Matrix. Deliverable: Complete, Final Set of Tables and Figures.	(Execution Week - No Reading)
		Week 10	Attention Mechanism		
		Week 11	Final Evaluation & Graphs		

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		Week 12	Proposed Method Draft	Write the Methodology and Proposed System sections, detailing the dataset, feature selection, and the mathematics/architecture of the RNN + Attention model. Deliverable: Draft Section: Proposed Method (3-4 pages).	(Writing Week - Focus on Detailing Your Work)
				Write the compelling Abstract and the fully structured Introduction (Motivation, Gap, Contribution, Structure). Deliverable: Polished Abstract and Introduction Sections.	(Writing Week - Focus on Clarity and Impact)
				Complete the Related Work (using Week 3-4 notes) and the Experiments & Results sections (inserting Week 11 tables/figures). Deliverable: Draft Sections: Related Work and Experiments/Results.	(Writing Week - Citing All Foundational Papers)
				Write the Discussion (analyzing trade-offs and novelty) and Conclusion (summarizing findings and defining Future Work, e.g., Edge	(Writing Week - Critical Analysis & Synthesis)
Phase 4: Writing & Submission	4 Weeks	Week 13	Abstract & Introduction		
		Week 14	Related Work & Results		
		Week 15	Discussion & Conclusion		

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				Deployment). Deliverable: Full Paper Draft (First Complete Pass).	
				Final proofreading, grammar check, and plagiarism check.	
		Week 16	Proofread & Submit	Format the entire paper strictly according to the target conference template (e.g., IEEE). Deliverable: FINAL CONFERENCE SUBMISSION 🇬🇧	(Final Polish & Formatting)

**Actionable Next Steps (Since Week 1 & 2 are done):**

- 1. October (Week 3):** Start immediately with the IDS Landscape survey.
- 2. Document Management:** Save this plan and start a parallel document for your paper where you drop the weekly deliverables (diagrams, tables, gap statements). This accelerates the final writing phase.
- 3. Tool Setup:** Ensure your development environment (Python, TensorFlow/PyTorch, necessary libraries) is ready for data handling and the RNN implementation in November.

## Month 1: Understanding the Field (October)

### Goal:

Build solid conceptual base and identify your research gap.

#### ◆ Week 1:

- Read 2 short survey papers:
  1. *Hafeez et al., 2023* – SDN-VANET Architecture (IEEE Access)
  2. *Nguyen et al., 2022* – SDN for Vehicular Networks (IEEE Surveys & Tutorials)
- Make quick notes:
  - SDN architecture for VANETs
  - Planes (Data, Control, App)
  - Why SDN helps VANET (central control, dynamic routing)
- Deliverable:
  - One diagram: SDN-VANET architecture
  - One paragraph: “Why SDN for VANET?”

#### ◆ Week 2:

- Read 2 IDS-related surveys:
  1. *Qureshi et al., 2024* – IDS in SDN-VANETs
  2. *Alharbi et al., 2023* – ML/DL Security for VANETs
- Make a table:

Paper	Dataset	Method	Metrics	Limitations
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- Identify missing elements like:
  - No temporal modeling
  - Lack of real-time testing
  - No integration with SDN controller

- **Deliverable: Research gap statement (4–5 lines)**
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## **Month 2: Problem Formulation & Design (November)**

### **Goal:**

**Finalize your problem, dataset, and architecture.**

#### ◆ **Week 3:**

- **Write clear problem statement:**

**“Existing IDS models in SDN-VANETs fail to capture temporal flow patterns. We propose an attention-based RNN for real-time anomaly detection.”**

- **Choose datasets:**
  - **VeReMi (vehicular misbehavior) — preferred**
  - **Or CICIDS2017 (for hybrid VANET traffic)**
- **Sketch your architecture:**
  - **Input: flow or mobility features**
  - **Layers: LSTM / GRU + Attention**
  - **Output: normal vs attack**
- **Deliverable: block diagram + short explanation.**

#### ◆ **Week 4:**

- **Review 2–3 similar models:**
    - *Huang et al., 2023* – Deep IDS for VANETs
    - *Saini et al., 2024* – LSTM-based IDS for VANETs
  - **Identify parameters they used (hidden units, sequence length, etc.)**
  - **Deliverable: design your RNN model configuration.**
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## **Month 3: Implementation & Experiments (December)**

### **Goal:**

**Train baseline models and your proposed RNN model.**

#### ◆ **Week 5–6:**

- Prepare dataset (normalize, encode, split train/test).
  - Implement baseline models:
    - Random Forest, SVM, CNN
  - Evaluate on metrics: Accuracy, F1, Recall, AUC.
  - Deliverable: Table of baseline results.
  - ◆ Week 7:
    - Implement RNN (LSTM or GRU) model.
    - Train & compare results.
    - Add attention layer for feature focus.
    - Deliverable: improved results + confusion matrix.
  - ◆ Week 8:
    - Compare all models (ML, CNN, RNN, RNN+Attention).
    - Perform lightweight ablation study (showing attention's impact).
    - Deliverable: Final performance table + graphs.
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#### Month 4: Paper Writing & Submission (January)

##### Goal:

Finalize and format your paper for conference submission.

- ◆ Week 9:
  - Write Abstract, Introduction, and Related Work using survey summaries.
  - Insert diagrams (architecture, workflow).
- ◆ Week 10:
  - Write Methodology + Experiments section:
    - Dataset description
    - Model design
    - Evaluation metrics
- ◆ Week 11:



- **Write Results, Discussion, and Conclusion:**
  - Highlight improvement
  - Discuss latency & scalability
  - Add “Future Work” (e.g., real-time deployment in SDN controller).

◆ **Week 12:**

- Proofread + format (IEEE double-column template).
- Check plagiarism (<10%) via Grammarly/Turnitin.
- Submit to target conference.

🔍 **Target Output (by January End)**

- ✅ Working model (RNN-based IDS)
- ✅ Result comparison with baseline
- ✅ 6–8 page formatted conference paper (IEEE/Springer format)

🔗 **Recommended Paper Sources**

- IEEE Xplore – main source for SDN-VANET papers
- Elsevier Computers & Security
- Springer Neural Computing & Applications
- arXiv.org (for open-access preprints)

📅 **Summary Timeline (Condensed)**

Month Focus		Outcome
Oct	Learn SDN-VANET + IDS landscape	Research gap + background
Nov	Design architecture + select dataset	Defined problem + model design
Dec	Implement models + experiments	Results + graphs
Jan	Write & submit paper	Final conference paper